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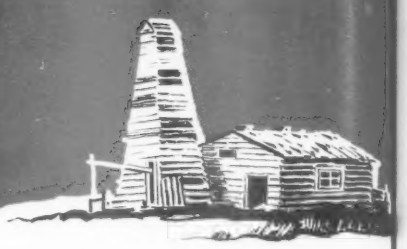
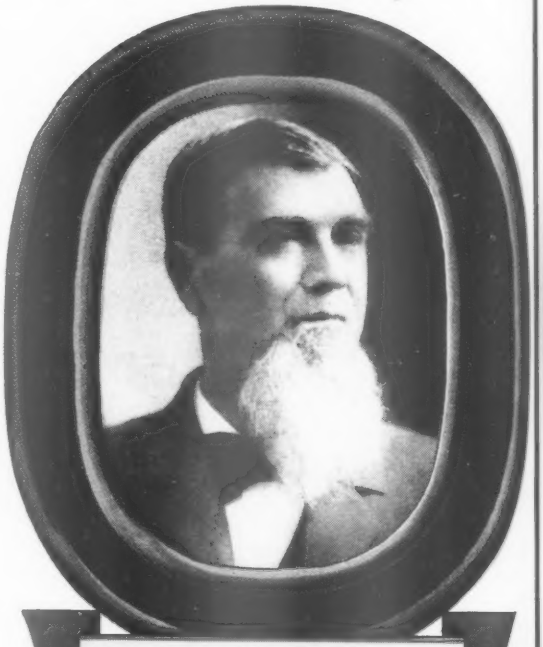


Darn Near as Old as the Oil Industry!

BOVAIRD is a veteran in the oil well supply business. Founded in 1871 by the late David Bovaird, just a few years after Col. Drake drilled his first oil well, Bovaird pioneered the servicing of an infant enterprise which was to become the great Petroleum Industry of today.

The Bovaird Supply Company is proud of its record; grateful for the privilege of serving. Bovaird has not only witnessed the dramatic history of the oil industry; it has, in a small way, helped to write the story, thanks to the confidence and patronage of the industry.

Thousands of oil operators—individuals and companies—have come and gone—hundreds of supply firms have been merged, absorbed, liquidated; changed ownership and management, through the years. But Bovaird is still in the same business, under the same ownership - management after nearly three-quarters of a century.



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the OIL AND GAS JOURNAL

Trends

Crude-Oil Production
By States — Page 98

CRUDE-OIL STOCKS 233,632,000 bbl. as of April 22—down 556,000 bbl. One year ago 242,035,000 bbl.

GASOLINE STOCKS 88,729,000 bbl. as of April 22—down 49,000. One year ago 90,751,000 bbl.

RESIDUAL FUEL-OIL STOCKS 51,061,000 bbl. as of April 22—down 653,000.* One year ago 67,494,000.

GAS OIL AND DISTILLATE STOCKS 30,495,000 as of April 22—down 66,000. One year ago 30,838,000 bbl.

CRUDE-OIL PRODUCTION 4,436,000 bbl. daily average week ended April 29—up 10,600 bbl. Year ago 3,896,295 bbl.

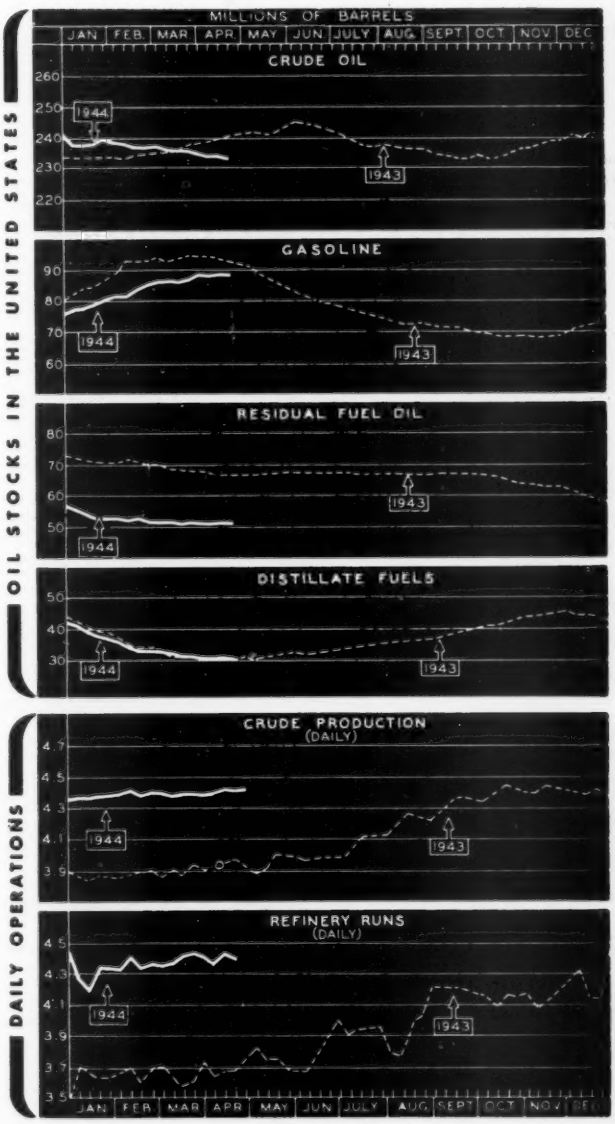
REFINERY RUNS 4,390,000 bbl. daily week ended April 22—down 57,000 bbl.

*Stocks week ended 4-15-44 revised.

WHILE the governmental oil plans, as reflected in the Anglo-American conferences and the Senate foreign oil-policy committee hearings, are yet to take definite form, thinking within the petroleum industry is becoming more crystallized. Developments at the Bradford meeting of the Independent Petroleum Association of America left few questions unanswered as to where the independent producers stand in pending matters affecting domestic and foreign oil operations. In this connection students of the industry are pointing to the differences of opinion that exist in regard to postwar oil policies. They are endeavoring to analyze developments because of their direct bearing on postwar operations.

AT the one extreme are those who see no reason why postwar oil operations should not follow the prewar operating patterns in this country and elsewhere. They are opposed to governmental participation in petroleum operations outside this country such as is proposed in the Arabian pipe-line project. They favor an immediate easing of regulations by Government in domestic operations with all controls, including price, to end as soon as peace is declared. Petroleum properties owned by the Government either would be disposed of to private interests on a basis of their worth in peacetime operations or junked. Under this program petroleum operations in the United States would be on the same basis as they were before the war.

AT the other extreme is a postwar oil program credited to governmental leaders who may or may not represent the final thinking of the administration. This program, it is said, would make petroleum a key medium in working out a permanent international policy, the Government participating as a partner with its nationals in foreign oil operations wherever it was considered expedient to do so. It is made clear that such a plan would of necessity mean continued federal control of domestic operations. Between these extremes are many viewpoints. Within the petroleum industry participation by the Government in foreign oil operations is opposed, but stronger support for nationals operating outside this country is approved. Suggestions as to what should be done vary from the adaptation to foreign oil operations of the voluntary interstate oil compact in this country to signed agreements among the principal oil-producing countries covering the world production and distribution of petroleum.



100-Octane Fuel Output Totals 400,000 Bbl. Daily

WASHINGTON. — Hundred-octane aviation gasoline is now being produced at the rate of more than 400,000 bbl. per day, Petroleum Administrator Ickes announced last week.

Disclosure of this hitherto secret figure was made at a special press conference, atended by high Army and Navy officials, launching "100-octane week" in celebration of the tenth anniversary of the first sale of 100-octane gasoline to the U. S. Army. Other features of the "week," April 30 to May 7, are a large number of special radio programs, speeches by government officials, and a trip on a Navy aircraft carrier in Chesapeake Bay by representatives of eastern refineries.

A fact book on production of 100-octane and its value to military aviation is being distributed by PAW, and this information was supplemented by a press conference discussion by Assistant Deputy Administrator Bruce K. Brown and W. W. White, PAW aviation officer.

Information thus made available included the following:

The 400,000 bbl. per day of 100-octane now being produced is in addition to 125,000 bbl. per day of 91 and 87-octane aviation gasoline.

The current output of 100-octane is nowhere near the ultimate goal, and the rate will increase steadily during the summer and fall as additional plants are completed. Construction work on the program is about 85 per cent completed, but this is not an indication of ultimate maximum production because there is a considerable lag between completion of construction and capacity operation. Some plants already completed are not yet actually producing.

As soon as production reaches the maximum figure estimated by the Army and Navy as their total needs, attention will be turned to improving the quality, chiefly by increasing the proportion of alkylate, reducing the end point and by making other alterations in specifications. This may involve some decrease in quantity or at least limit increased production. Some additional construction may be required but in the direction of improving quality.

The current 400,000 bbl. daily production is 10 times the Axis output of aviation fuel before the start of Allied bombings, and is more than twice the consumption of all petroleum products during World War I.

Only about one-sixth of the total quantity of aviation gasoline available at a given time is at the fighting fronts because of the supplies in process of manufacture, in transit and in reserve storage in war theaters.

The cost of 100-octane to the Army and Navy is 16 cents per gallon from the Defense Supplies Corp. DSC purchases from refiners at various prices negotiated on the basis of cost plus a reasonable profit, regardless of the relative economy of the various processes and locations. These prices range from 12½ to 17 cents per gallon, and are roughly 2 cents per gallon below prices prevailing when the war broke out.

The total cost of the Government's aviation gasoline facilities program is about $900,000,000, of which 760,000,000 is for plants in the United States; 82 per cent of the ultimate capacity will be privately owned; three-fourths of the government outlay is for equipment for small refineries.

Bruce K. Brown, deputy petroleum administrator, amplifying Petroleum Administrator Ickes' announcement that current Allied production of 100-octane gasoline is 400,000 bbl. daily, the first public disclosure of the rate of aviation-fuel manufacture

Shell Dedicates Twin Cat Crackers

A companion story describing operating aspects of Shell Oil Co., Inc.'s Wood River refinery starts on page 33 of this issue.

ON the site of the original production of 100-octane aviation fuel, 10 years ago April 30, Shell Oil Co., Inc., officials in company of about 7,000 visitors dedicated to the manufacture of more aviation superfuel two fluid catalytic crackers which have just gone on stream at the Wood River refinery. Led by Alexander Fraser, Shell's president, and accompanied by Under Secretary of War Robert P. Patterson, the Navy's Rear Admiral T. Earle Hipp, and a large number of military and naval leaders this dedication and celebration was one of the most colorful of all those held in this country.

High spot of the ceremonies was the address by Lt. Gen. James H. Doolittle, from London, where he commands the Eighth Air Force, to the audience at Wood River, while Mrs. Doolittle listened smilingly from the group of speakers and celebrities on the platform in the "big top." General Doolittle, a pioneer in aviation development with the Shell for many years before he was released to join the armed forces, leader of the famed air raid on Tokyo, told of the 1,300 planes of Germany's Luftwaffe which the Eighth had downed during April 1944, of the additional numbers destroyed by the Ninth, Twelfth and Fifteenth American air forces, of the British RAF forces. He outlined the accomplishment of dropping 24,000 tons of bombs on 28 German airplane and airplane-parts fac-

tories in Fortress Europe and on other critical targets in the softening process. In this biggest month of the air force's operations, of which April 30 was the sixteenth consecutive and most intensive day, we lost 359 bombers and 144 fighters, a great number of the men of which are believed to be safe but prisoners of war in Europe, he said.

Under Secretary Patterson disclosed that we are now producing 400,000 bbl. of 100-octane fuel per day to power these planes hammering Europe. Interesting is the fact that exactly 10 years ago the Shell company shipped from the Wood River refinery the first 1,000 gal. of 100-octane to the U.S. Army for experimental work which led to present use of this type fuel for military purposes. Just before the main ceremonies officials assembled at the site of the original units for 100-octane fuel, and buried a "time capsule" containing records of this first fuel development along with a sealed bottle containing a sample of the original shipment, the whole being placed within a concrete vault, topped by a monument consisting of a globe surmounted by a diving plane.

President Fraser summarized the numerous contributions of the oil industry to the war program and how that industry is providing so much of the critical materials required for war. In addition to the aviation fuel which he stated gives aircraft an unavoidable superiority in the air he mentioned the production of huge quantities of toluene, a part of which is synthesized in the Wood River plant for explosives and aviation fuel, and the lubricants, trucks and tank fuels which are powering the other equipment of the armed forces.

One drawback the Japanese have in meeting our air force successfully is poor fuel, Admiral Hipp stated. He mentioned the capture of a quantity of fuel in a cache at an airstrip taken in the South Pacific and it was found unsuitable for planes, jeeps, trucks, or even for gasoline-powered radio transmitting equipment.

Visitors were shown through the refinery prior to the main ceremonies, seeing the toluene synthesizing units, alkylation unit, the catalytic crackers one of which has been operating for several weeks, the younger of which had just gone on stream a week or two previously.

District 2 Refiners Must Share Gasoline

WASHINGTON. — Every refiner in District 2 should supply the military with at least 20 per cent of his daily average gasoline manufacture in the form of aviation gasoline, aviation fuel components, or 80 octane, and those who do not may be directed to deliver motor gasoline to supply civilian markets of refiners who do, Deputy Petroleum Administrator Davies has informed W. W. Vandeveer, director in charge of District 2.

Davies authorized Vandeveer to direct District 2 refiners to deliver motor gasoline to other refiners where necessary to assure equitable distribution of all gasolines. He declared that some refiners will be required to supply military gasolines in such quantities that they will be unable to meet current rationed demand for essential civilian and industrial uses. The authorization includes formulas for determining what percentage of average daily runs a refiner is delivering to the military, and the quantities of gasoline other refiners must supply as replacements.

Oil-States Caucus Demands Higher Crude Ceilings

WASHINGTON. — A demand that Congress require Office of Price Administration to fix higher price ceilings on crude petroleum as an amendment to the pending oil bill to extend the price stabilization act was made May 2 by a caucus meeting of more than 100 house members from oil-producing states. The meeting followed appearance before the House banking and currency committee of Russell B. Brown, several counsel of Independent Petroleum Association, and others. They presented charts and other material similar to what was shown to the Senate committee by Brown last week in asking for an oil price ceiling amendment to the OPA extension bill.

Synthetic-Fuel Projects Pushed by Bureau of Mines

WASHINGTON.—The Department of the Interior is going ahead with plans for building test plants to develop a synthetic-fuel industry, and will ask for an appropriation "in the first bill we can catch," Secretary Ickes told the House appropriations committee recently.

Work in making gasoline by hydrogenation process has been going on in the Bureau of Mines laboratories for some time, and the demonstration plants will put laboratory testing into the field of actual operation on an experimental basis.

Congress recently passed a synthetic-fuels bill authorizing an appropriation of $30,000,000 for the program.

Texas Panhandle Spacing Relaxed

WASHINGTON.—Relaxation of the well-spacing restrictions in the Texas Panhandle has been authorized by the Petroleum Administration for War in an amendment to Supplement 11 to PAO-11, issued May 2 and effective immediately.

The relaxation applies to Wheeler, Gray, Carson, Hutchinson, and Moore counties and is for the purpose of permitting additional drilling and production to supply certain refineries which are dependent on oil from this area exclusively.

Spacing restrictions have been reduced from 40 acres to 20 acres and wells may be 660 ft. apart instead of 900 ft., but the order retains the restriction on locating wells closer than 330 ft. from a property line.

Helium Production Equals Needs for Military Forces

WASHINGTON.—Helium production is now equal to the present needs of the Army and Navy, and upon completion of present projects, will equal estimated military demands.

Total production is more than 25 times that of prewar years. The Amarillo plant now produces at a rate five times greater than its original output. The new Excell, Tex., plant produced as much in 7 months as the now extinct Fort Worth plant produced in 8 years. Other plants in operation or under construction, will help meet all military and civilian demands. Production costs are now less than 2 cents per cubic foot.

House Cuts Hot-Oil-Law Enforcement Budget

WASHINGTON. — Funds for the enforcement of the Connally Hot Oil Act were reduced by the House to $200,000 in the Interior Department's 1945 appropriation bill. The 1944 appropriation was $235,000.

The need for enforcing the law, J. W. Steele, acting director of the Petroleum Conservation Division, told the appropriations committee, is no less today than when the law was passed.

"If anything," he said, "the need for enforcing measures to conserve the oil and gas resources of the nation is greater than ever due to the rapid withdrawal of such resources."

Committee members questioned Steele on the need for enforcing the act at all, in view of the need for production for war. Steele pointed out that without the law, some producers would waste future oil in the interest of war profits.

Exploration Spreading in Mississippi Oil Prospects

by William Clifford Morse*

William C. Morse, director of the Mississippi Geological Survey since 1934, has spent 38 years teaching and practicing geology. He is considered one of the outstanding authorities on the geology of Mississippi and is the author of several books and special publications on the geological features of that state. Current interest in Mississippi makes this summary especially timely.

NOTWITHSTANDING Dr. E. W. Hilgard's discovery and description of the Jackson dome in 1859 and 1860, it was 1903 before the first well was drilled in the search for oil in Mississippi. And it was 1930 before the first gas well was completed in the Jackson gas field, it having been preceded only by three gas wells in the small Amory gas field. And after the initial Jackson gas well, it was nearly a decade before the first commercial oil well was completed, on August 29, 1939, on the Tinsley dome.

For more than a third of a century, even with the drilling of more than 260 wells outside the Jackson area of 203, the search continued at a cost that no one has even estimated—a fact so commonly overlooked by federal and state planners who know little of the geologic conditions of oil and gas origin.

On the credit side of the ledger may be posted first the billion and a half cubic feet of gas that the three-well Amory gas field produced in the decade of its existence. Next is the production of the Jackson gas field:

	Cu. ft.
1930	587,000,000
1931	6,164,000,000
1932	9,675,000,000
1933	9,406,000,000
1934	9,001,000,000
1935	10,291,000,000
1936	12,969,000,000
1937	14,248,000,000
1938	14,298,000,000
1939	15,233,000,000

Some 15,000 bbl. of heavy black oil came from its three wells.

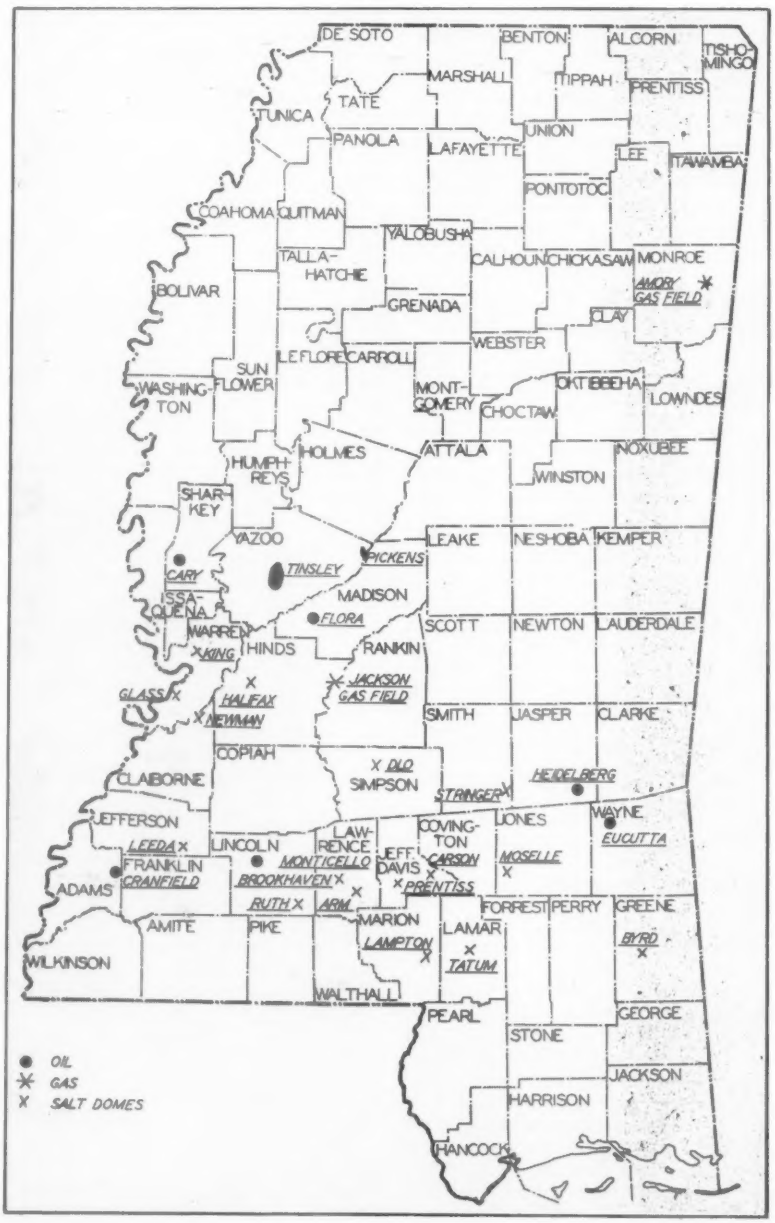
Start of Modern Development

Then, on August 29, 1939, almost 80 years to the day after the bringing in of the Drake well on Oil Creek, Pennsylvania, as the first oil well of the United States, Union Producing Co. brought in 1 G. C. Woodruff, on Tinsley dome, as the first commercial oil well in Mississippi. How much confidential parallel information the geologists of Union and other corporations may have had has not been revealed to the public. More than a third of a century of search, more than 460 wells drilled—then the first oil well in Mississippi!

By August 30, 1941, 2 years after

(Continued on page 116)

*Mississippi state geologist.



Areas around the new fields and known salt domes are receiving major attention in currently rising exploration operations in Mississippi

THIS WEEK

REFINING—Current production of 100-octane gasoline disclosed to be 400,000 bbl. daily. . . . Plants still under construction or just starting operations will substantially augment output by year end. . . . ¶Emphasis in last quarter will shift to improvement of quality. . . . ¶Possibly two or three additional catalytic-cracking plants will be needed, if ultimate in quality is realized. . . . ¶District 2 refiners instructed to divert 20 per cent of current motor fuel production to military forces. . . . or to turn equivalent amount to other plants which are supplying Army and Navy. . . .

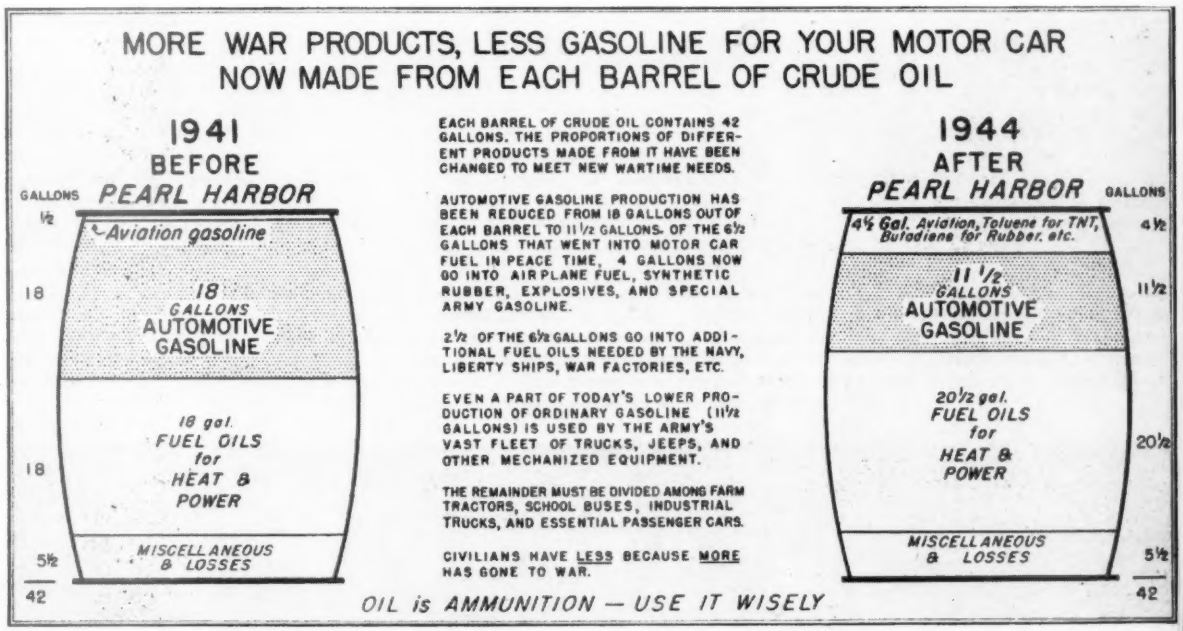
INTERNATIONAL—Gulf Exploration Co. contract with Anglo-Iranian Oil Co., Ltd., on Kuwait among points discussed by American-British mission. . . . Terms prohibiting Gulf from marketing in Anglo-Iranian "territory" barrier to Arabian pipe line. . . . Compromise solution suggested for entire Middle East, covering all proven fields. . . . ¶Material export restraints being liberalized, permitting upward revision of most South American programs, on modest scale. . . . ¶Trucks and automotive parts most critical need of industry in Venezuela, Colombia, Mexico. . . .

SUPPLIES—Military is consuming, or earmarking for shipment, 37 per cent of all current gasoline production. . . . ¶One barrel at fighting front means four must be in far-forward storage, in transit, or in process of manufacture. . . . ¶Wide margin of safety in military-supply lines maintained—at insistence of Joint Chiefs of Staff. . . . ¶Administrator Ickes blights hopes of easteners for increased civilian gasoline—says such action would create inequitable reductions elsewhere. . . . Reminds eastern motorists that East Coast stocks of 14,000,000 bbl., provide only 1,500,000 bbl. above minimum working stocks. . . .

DRILLING—Revisions in completions, covering tardily reported wells, improve comparison between PAW program and first quarter results. . . . Estimates swinging to complete fulfillment of 24,000-well program, if manpower support is adequate. . . . ¶Spacing limitations relaxed in Texas Panhandle, allowing 20-acre pattern, 660 ft. between wells. . . .

MANPOWER—Industry's ability to meet all programs—manufacturing, producing, drilling, transporting—hinges around this unknown. . . . ¶PAW commended by top executives for working out most immediate problems with Selective Service, regional, state and local boards. . . . Appreciation of industry's essentiality may prove temporary, requires constant vigilance. . . . ¶Individual companies and operators can aid themselves by following instructions specifically in filing deferment applications.

TRANSPORTATION—Overland movement to East Coast temporarily improved. . . . Forward requirements of military indeterminate. . . . ¶Application filed for 20-in. crude-oil line from West Texas to California. . . . When PAW will act, favorably or unfavorably, depends on completeness of application. . . . ¶Additional movement provided through Stanolind Pipe Line Co.'s West Texas to District 2 line. . . . Middle West refiners arrange to absorb more sour oil. . . .


MORE WAR PRODUCTS, LESS GASOLINE FOR YOUR MOTOR CAR
NOW MADE FROM EACH BARREL OF CRUDE OIL
1941
BEFORE
PEARL HARBOR
GALLONS
½
Aviation gasoline
18
18 GALLONS AUTOMOTIVE GASOLINE
18
18 gal. FUEL OILS for HEAT & POWER
5½
MISCELLANEOUS & LOSSES
42
EACH BARREL OF CRUDE OIL CONTAINS 42 GALLONS. THE PROPORTIONS OF DIFFERENT PRODUCTS MADE FROM IT HAVE BEEN CHANGED TO MEET NEW WARTIME NEEDS.
AUTOMOTIVE GASOLINE PRODUCTION HAS BEEN REDUCED FROM 18 GALLONS OUT OF EACH BARREL TO 11½ GALLONS. OF THE 6½ GALLONS THAT WENT INTO MOTOR CAR FUEL IN PEACE TIME, 4 GALLONS NOW GO INTO AIRPLANE FUEL, SYNTHETIC RUBBER, EXPLOSIVES, AND SPECIAL ARMY GASOLINE.
2½ OF THE 6½ GALLONS GO INTO ADDITIONAL FUEL OILS NEEDED BY THE NAVY, LIBERTY SHIPS, WAR FACTORIES, ETC.
EVEN A PART OF TODAY'S LOWER PRODUCTION OF ORDINARY GASOLINE (11½ GALLONS) IS USED BY THE ARMY'S VAST FLEET OF TRUCKS, JEEPS, AND OTHER MECHANIZED EQUIPMENT.
THE REMAINDER MUST BE DIVIDED AMONG FARM TRACTORS, SCHOOL BUSES, INDUSTRIAL TRUCKS, AND ESSENTIAL PASSENGER CARS.
CIVILIANS HAVE LESS BECAUSE MORE HAS GONE TO WAR.
1944
AFTER
PEARL HARBOR
GALLONS
4½ Gal. Aviation, Toluene for TNT, Butadiene for Rubber, etc.
4½
11½ GALLONS AUTOMOTIVE GASOLINE
11½
20½ gal. FUEL OILS for HEAT & POWER
20½
MISCELLANEOUS & LOSSES
5½
42
OIL is AMMUNITION — USE IT WISELY

Gasoline goes to war is the title given this chart by the Division of Research, Petroleum Administration for War, showing that automotive gasoline from a barrel of oil currently amounts to only 11.5 gal., compared to an average of 18 gal. before Pearl Harbor

Gulf's Kuwait Contract Discussed

by H. Stanley Norman

WASHINGTON.—Aspects of international petroleum affairs which concern only the British and American governments are under discussion here between members of the operating-level commissions representing the two countries.

This was learned last week despite the secrecy which shrouds fuller details and regardless of the innocuous statements from the Department of State which imply that only matters of broad general policy are under discussion.

One of the chief points of discussion concerns the contract between Gulf Exploration Co. and Anglo-Iranian Oil Co., Ltd., through which Kuwait Oil Co., Ltd., is jointly owned. Kuwait Oil Co. is the corporate instrumentality through which reserves estimated at approximately 10,000,000,000 bbl. have been developed in the Kingdom of Kuwait. The Gulf and Anglo-Iranian contract which was executed at the time Kuwait Oil Co. was organized to operate the concession in the Middle East provides that Gulf may not market its half of production in competition with Anglo-Iranian.

There are many missing details in the Gulf and Anglo-Iranian relationship, including just what territory is covered by the prohibition against the American company's marketing activities. Presumably, however, Anglo-Iranian reserved much of the Mediterranean area and probably much of Europe. Thus, it can be seen that Gulf Exploration Co.'s participation in the proposed Arabian pipe line, unless its contract with Anglo-Iranian can be modified, might prove a real stumbling block.

It was impossible to determine just what angle the discussions were taking but the general direction was obvious. There were two alternatives open if Petroleum Reserve Corp.'s proposed trans-Arabian pipe line is to be fulfilled: (1) Either the original contract between Gulf and Anglo-Iranian must be modified, or (2) Gulf's elimination from the tentative PRC agreement might be sought.

Line's Acceptance Impaired

None of the American interests which would benefit directly from the Arabian pipe line are willing to weaken the PRC proposal by disqualification of one of the triumvirate. Gulf is understood to oppose prosecution of the pipe-line plan unless the company is permitted to participate fully in the program. Consequently, much discussion both between the participating companies and PRC and between representatives of the American-British missions has centered around the perplexing question of how this may be done in view of the existing contract with Anglo-Iranian.

There is general agreement both among government officials and oil company representatives in Washington that the case for the Arabian pipe line would be materially weakened either if Gulf is eliminated or if it is necessary to include Anglo-Iranian oil in the line with the circumventions on marketing imposed by the Kuwait contract.

Discussions probably will be concluded here this week between the American and British missions. Conclusions reached at the current conferences would be referred back to the policy-making and cabinet levels of the two governments. International aspects of the recommendations would be subject to review by cabinets of both governments and carried forward from that point among the oil-producing countries of both hemispheres.

Presumably, however, the specific problem of the Gulf and Anglo-Iranian relationship would be a matter for settlement between the companies and their respective national governments, and with the consent of Kuwait. Public hearings before the special Senate petroleum resources committee, headed by Sen. Francis Maloney of Connecticut, will not open until the American-British discussions are completed. Decision to delay open hearings on the international petroleum problems was reached last week in an exchange of letters between Petroleum Administrator Ickes and Chairman Maloney. The postponement was instigated by a member of the committee.

Contrary to some impressions, PRC has made no definite commitment to postpone action on the Arabian pipe line until after the Senate committee concludes its hearings. Such a commitment, it was pointed out, would transfer power of action to hands of the committee in that hearings could be theoretically strung out over an indefinite period. PRC has assured Chairman Maloney and other members, however, that no additional tangible action will be taken without notifying the committee.

E. B. Swanson, director of the Research Division for the Petroleum Administration for War, last week became secretary of the PRC, succeeding Abe Fortas, under secretary of the interior, who was forced to relinquish his post because of regular departmental duties.

Broad and specific questions of international petroleum are under discussion by this group which includes Sir William Brown, chairman of the British delegation; Charles B. Rayner, petroleum adviser to the U.S. Department of State; Sir William Fraser, chairman, Anglo-Iranian Oil Co., Ltd. J. H. LeRougetel, Ralph K. Davies, deputy petroleum administrator; F. C. Starling, Col. H. Blake-Tyler, Harold Wilkinson, William Hoyter, Sir Frederick Godber, managing director, Shell Transport and Trading Co., Ltd.; F. Harmer, Commodore A. W. Clarke, Victor Butler, Paul Alling, Leroy Stinebower, Commodore A. F. Carter, Brig. Gen. H. L. Peckham, C. S. Snodgrass, John Loftus, George Walden and James C. Sappington III

Charge stock for the alkylation and cumene plants are among the products of the gas plant at Wood River, shown here. Towers in the foreground handle gases produced in catalytic cracking

Shell's Wood River Plant Exemplifies Progress in 100-Octane Manufacture

by John P. O'Donnell

PROGRESS in the manufacture of 100-octane aviation gasoline, most important wartime product of the oil industry, is exemplified by the Wood River, Ill., refinery of Shell Oil Co., Inc.

Steps to place the Wood River refinery on a wartime footing were begun more than 2 years before Pearl Harbor. In the 5 intervening years its crude-oil charging capacity has been almost doubled. In 1939 it was 45,000 bbl. per day, whereas now it is 85,000 bbl. per day. All the units contributing to the expansion of the refinery's capacity were added to improve its ability to produce war products. Before Pearl Harbor Wood River was one of the few refineries in the country producing 100-octane-fuel components. The expansion program begun then has continued without interruption so that its capacity to produce these products and other military and industrial needs has increased substantially.

Three new topping units, charging 15,000, 27,000 and 32,000 bbl. per day, were added in 1939, increasing the refinery crude capacity to 75,000 bbl. per day. Since then the last two have been raised to 35,000 bbl. per day to make the refinery capacity its present 85,000 bbl. per day and rank it with the dozen largest in the country. An alkylation unit, capable of producing 1,500 bbl. per day of alkylate, was included in the 1939 program. The second program, completed in 1942, embraced additional fractionation equipment to segregate and recover 1,500 bbl. per day of isopentane, a valuable 100-octane component, and 700 bbl. per day of toluene including the production of two new plants for the conversion of naphthenes. This program likewise included a modern two-column fractionating plant for Mid-Continent crude with three highly efficient fractionating columns for naphthas and an Edeleanu extraction plant for the production of special naphthas.

Additional information on 100-octane aviation-fuel manufacture appears in a related article on page 28 of this issue.

The third expansion program in this brief period is now in the completion stage. It included the expansion of the topping capacity, the addition of a second and the revamping of the first alkylation units. This increased the refinery's capacity for the production of this aviation gasoline blending agent to 5,000 bbl. per day. The outstanding addition to processing equipment in the third program are two fluid catalytic cracking units having a combined charging capacity of 31,000 bbl. per day, with attendant catalytic treating facilities for the base stock which they produce. An isomerization plant, designed to produce 1,200 bbl. per day of isobutane to accommodate the expanded alkylation facilities, was also included in this program.

These units are, of course, supplemented by treating, stabilizing, fractionation and handling facilities. Much of this equipment as well as some of the large pieces in the main units were converted from existing equipment through the ingenuity of the refinery personnel or from material brought in from the company's abandoned East Chicago refinery. This utilization of available equipment accounted for savings both in time and money.

The topping units at Wood River contribute to 100-octane production by furnishing the charging stock for the toluene, pentanes and catalytic cracking plants. The topping section comprises three units, Nos. 2, 3 and 4, the latter two of which are identical, in addition to some standby equipment consisting of modernized Trumble stills. No. 3 and No. 4 charge 35,000 bbl. per day. Their fractionation sections consist of three towers, each equipped with reboilers, with two takeoff strippers on the third column.

Overhead from the first column, consisting of C_5 and lighter fractions, furnishes the charge for the pentanes plant. The second column's overhead, C_6s to C_{10}s, provides the charge for the toluene plant. Overhead from the third column, material in the 300°-400° F. boiling range, is charged to the thermal reforming units. Two gas-oil cuts are taken from the third column and stripped, one a heating-oil product cut and the other a part of the charge to one of the cat crackers. Bottoms from the third tower pass to a vacuum flashing section consisting of four old Dubbs units where a 60 per cent overhead cut is obtained as an additional source of charge for catalytic cracking.

Topping unit No. 2 includes primary and secondary atmospheric towers, a vacuum distillation tower and three solvent columns. Overhead from the first atmospheric tower, 225° F. end point material, is charged to a dehexanizer, the first of the solvent towers. Primary tower bottoms go to the secondary tower which produces, as overhead, the charge for the remaining solvent columns and, as bottoms, the charge for the vacuum distillation unit. Products of the latter are a gas oil charge for catalytic cracking and the various cuts which are sent to the lubricating oil dewaxing, solvent-extraction and deasphalting plant.

The dehexanizer, treating the primary tower overhead, produces additional charge for the pentanes plant and a bottom fraction or rubber solvent. Part of this may be run to the so-called No. 1 naphtha tower. However, at least a portion of the charge to the No. 1 naphtha tower as well as the full charge to the No. 2 tower consists of the overhead of the secondary atmospheric tower. No. 1 separates its charge into Benzo-sol, a 140°-190° F. fraction, and Tolu-sol, a 190°-240° F. fraction. No. 2 produces a 200°-300° F. V.M.&P. solvent and a 300°-400° F. Stoddard solvent.

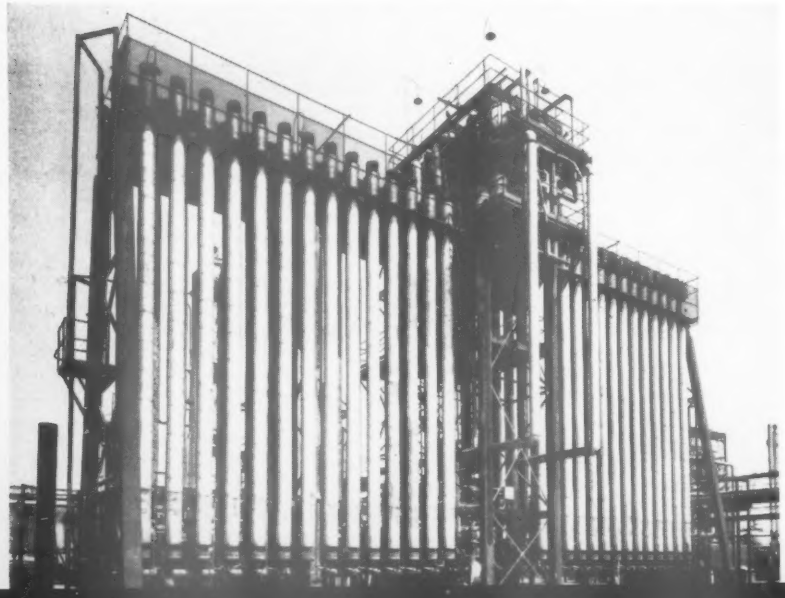
Pentanes Plant

The pentanes plant, charging light ends produced in the topping operation, produces isohexane and isopentane, both of which are used as aviation gasoline components. The pentanes plant consists of four towers operating in series, a 7-ft. diameter, 50-tray debutanizer, an 8-ft. 6-in. diameter, 70-tray depentanizer, a 10-ft. 6-in. diameter, 70-tray deisopentanizer and 4-ft. diameter, 40-tray debutanizer. It was decided to add the 70-tray depentanizer after construction had begun. Since the other columns and much of the piping had been installed it was impossible to raise this tower on its site. Therefore it was raised in the bordering roadway and moved into position on rollers.

The first debutanizer serves as a feed preparation column for the remainder of the system by removing most of the C_4 and lighter fractions and concentrating the C_5s and C_6s. The depentanizer separates the pentanes and hexanes.

Normal and isopentane removed in the depropanizer are separated in the deisopentanizer, the overhead consisting principally of iso C_5s with some C_6s and the bottoms consisting of normal pentane. The latter is used in motor gasoline while the former is treated in the fourth column for the removal of remaining C_6s. The resultant isopentane is used as an aviation-gasoline component.

Cumene, a product which accounted for a 22.8 per cent increase in 100-octane production in 1943, is produced in this unit. The unit was converted from another use to the production of cumene



Gas Recovery

Separate gas-recovery systems serve the thermal and catalytic cracking units. The two Dubbs thermal units have a combined capacity of 33,000 bbl. per day and the catalytic cracking units, 31,000 bbl. per day, so that there is a large supply of gases available for conversion into useful products.

Wet gases from the thermal cracking units enter the absorber where the methane and ethane are withdrawn at high pressure and run through gas turbines before discharging to the fuel system. The enriched oil enters the fractionator through a flash chamber. These latter columns are served by a furnace of 70,000,000 B.t.u. heat capacity.

Overhead from the first fractionator is combined with the light ends from thermal cracking and reforming stabilizers before subsequent depropanization and debutanization. The depropanizer overhead goes to the common deethanizers which serve both the thermal and catalytic cracking gas recovery systems while the heavier fractions go to the debutanizers which separate them into C_4s for treating as charge to the alkylation unit and C_5s and heavier for use as a component of motor gasoline.

Gases charged to the catalytic cracking gas recovery system are compressed in a two-stage compression plant before passing to the absorber. The dry gas flow is similar to that of the thermal recovery system. The absorbed gases are separated in a fractionator from the enriched oil. The recovered gas, plus light ends from the catalytic-cracking-unit stabilizers and the high-pressure compression system, are then successively debutanized and depropanized. Bottoms from the debutanizer, consisting of C_5s and C_6s, are separated. The C_4s are treated and sent to the alkylation system. The C_6s, being mostly isohexane, are blended with the catalytic base stock. The C_4s removed in the depropanizer as a bottoms product are treated and charged to the alkylation unit. Propane and lighter fractions obtained in the depropanization steps of the two recovery systems are charged to the common deethanizers which produce the C_3 fraction to furnish the propylene feed to the cumene plant.

Wood River's sulfuric acid alkylation plants have a combined capacity

(Continued on page 106)

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Refinery Horizons Widen

As plans are completed to bring this war home to the enemy on the remaining fronts it is fitting that the entire nation should give special recognition to the manufacturers of the petroleum industry whose accomplishments largely account for the fact that the world conflict is in its final stages, with Allied victory assured.

Information, previously restricted, released this week, covering the production of 100-octane gasoline, should result in greater appreciation throughout the country, including Washington, of the vital part this industry has in winning the war.

The Journal, four days after Pearl Harbor, commenting on the industry's preparedness, predicted: "The development of new processes will now bring returns in the form of assurance that this country's flyers will have important advantages over the enemy." Today's fulfillment of that prophecy and the assured expansion over the remainder of the year dwarfs the program in mind 2½ years ago. Competent observers agree that the production of gasolines for aviation and of butadiene for the closely allied synthetic rubber program, will be recorded in the history of this war as the greatest single achievement by industry.

It would be impossible to determine definitely just where credit should start and where it should end. The genesis of the 100-octane program goes back to many years of prewar research, during which the laboratory chemists produced certain petroleum hydrocarbons and also determined their superior performance in engines.

Fortunately, the processing arts in the production and blending of these hydrocarbons into finished high-octane fuels were established on a small-scale basis previous to the emergency. What has been done since then reflects the activities of the owners of several hundred refineries and natural-gasoline plants in cooperation with the builders and the manufacturers of materials and equipment. Competent direction came from the refining division of the Petroleum Administration for War, manned by representatives of the industry.

The results need little elaboration. Expenditures will total 900 million dollars. In this country 82 per cent of the 760-million-dollar cost will be paid by private owners. The 400,000-bbl. daily production, as of today, probably is greater than all the petroleum and its substitutes now available to the enemy. It exceeds by more than 60 per cent the output of all gasolines in this country in 1918. It is about equal to the civilian consumption of motor fuels west of the Mississippi River in the early thirties. With several large units yet to come on stream, present production will be increased substantially.

Four hundred refineries have contributed directly to the 100-octane program and because it has been necessary to maintain or expand the prewar output of most products for civilians, all refinery and natural-gasoline plant operations have been coordinated. Every branch of the entire industry, in fact, has contributed essential parts of the whole.

The benefits of what has been done in aviation gasolines will not end with the war. Refiners have learned many things that are not being used in the war program. Application of chemical principles is the basis for what has been accomplished, and with the emergency over, developments in chemical processing and utilization as important in peace as in war are assured. Aviation gasolines have permanently widened the manufacturing horizons of the petroleum industry.

Occupying places at the speakers' table at the opening session were: State Senator Thomas B. Wilson, Parker L. Melvin, Towne-Melvin Oil Co.; Gov. Edward Martin of Pennsylvania; N. W. Shiarella, Owensboro, Ky.; J. D. Sandefer, Jr., president, National Stripper Well Association; Mayor Hugh Ryan of Bradford, and Ralph T. Zook, president, I.P.A.A.

Foreign Competition Vies With Price for Consideration at I.P.A.A. Meeting

by John P. O'Donnell

BRADFORD, Pa.—The two principal problems of the independent oil operator, competition of foreign oil and an adequate price for domestic oil, were discussed in detail at the semiannual meeting of the directors of Independent Petroleum Association of America here last week. The meeting coincided with the midyear gathering of National Stripper Well Association, and together they attracted several hundred oil men from all parts of the country.

Opinions of the association on these problems were expressed in resolutions adopted at the meeting. These resolutions included:

1. That Congress, in renewing the Emergency Price Control law, give consideration to the need for finding oil, to the conservation of oil and to costs involved, and, also, to the parity relationship between oil and other commodities.

2. Support of the Senate committee on national oil policy with the request that it conduct a "most searching investigation" into all known factors of supply and demand.

3. Reaffirmation of its opposition to the encroachment of Government into business competition with private industry.

4. Reaffirmation of prior declarations "in opposition to government participation in general and to the Saudi Arabia pipe line specifically."

5. Petition Congress to apply income tax laws to cooperatives "engaged in the production of goods and commodities" and to prohibit federal financing of such projects.

6. Petition Congress to investigate federal acquisition of land; recommend to the Interior Department its royalty policy should be comparable to that of private industry.

7. That PAW make strong representations for the deferment of men "essentially engaged" in exploration and development.

8. That PAW relax PAO-11 "as well as other similar regulations in states where adequate statutory authority has been provided."

Price Question Introduced

Price was introduced as a topic by the first speaker, J. D. Sandefer, Jr., president of the National Stripper Well Association. He compared the abandonment, because of an inadequate price, of a well still capable of producing secondary-recovery oil to a "war plant that is not allowed to produce its maximum of planes, shells or ships."

Maj. Gen. Edward Martin, Pennsylvania governor, raised the subject of foreign oil when he condemned the proposed Arabian pipe line as an instrument that "may easily lead us into a third world war."

Ralph T. Zook, president, I.P.A.A., in an analysis of the Arabian pipe line from the independents' viewpoint, said that Arabian oil can be delivered at New York Harbor at $1.47½ per barrel against $1.62 for East Texas oil and pointed out that "any refinery will find 15 cents per barrel additional margin most attractive."

Russell B. Brown, general counsel for I.P.A.A., spoke of restrictions on oil operations despite increasing national needs. He listed more than a score of federal agencies which regulate or direct petroleum activities and declared that oil men "have the right to expect and we must insist upon some simplification of the confusion which now exists in government as to wartime regulation of oil."

Zook attacked the proposed Arabian pipe line as a threat to national security. It could lead to a permanently depressed domestic oil industry, he said, which, in turn, would threaten the safety of the country in the event of future wars. This pipe line would be a step toward fascism, "regardless of how poisonous this term is to some and how much they try to deny it."

Because of economic and competitive conditions in the Middle East, the laying of this line now could bring

on the market an additional 600,000 bbl. of crude oil daily. If that oil does not appropriate the European market, the speaker declared, then this 600,000 bbl. of new production will be "knocking at the door" of the United States on a competitive basis which will freeze the price of our domestic oil at not above and perhaps below the present level.

The oil producer in the United States, Zook continued, says "Give us material, manpower and an adequate price for crude oil, and we will find the necessary supply within the borders of the United States." If the oil industry is wrong, then the place to overcome deficiency in oil supply is the Western Hemisphere, our natural sphere of influence.

Governor Martin declared that a price increase is necessary to keep up production of oil. Instead of an increase, the price index of petroleum and its products has remained unchanged at 60 through the 2 years this country has been in the war, while farm products rose from 90 to above 110, metal products remained around 103 and food rose from 89 to 105. In further substantiation of his contention, the governor illustrated the meaning of an advance in price.

Among points which Brown discussed were acquisition of land by federal agencies, cooperatives, low-cost foreign crude and domestic crude prices. He cited a report showing that planned acquisitions will result in federal ownership of over one-fifth of the entire land area of the country. Much of this, he said, will be "subject to reservation to the United States of not less than an undivided three-quarters of the minerals."

Brown said that "co-ops" in the United States now own nine refineries, over 300 oil wells and more than 1,000 miles of pipe lines. "This form of competition may increase, probably will. There is no reason why it should not, for with federal assistance in financing and with freedom from income taxes, the cooperative oil business enjoys about the same advantages over private business as does a government corporation."

One full day of the meeting was devoted to the discussion of secondary-recovery practices. Among papers presented was a progress report on the horizontal-well project at Franklin, Pa., by W. M. Shoemaker, of Forest Oil Co. The fact that the project was undertaken in an area having a high-viscosity oil with little or no gas was described as unfortunate. "This fact, while making the sinking of the shaft easier, is detrimental in so far as producing the wells by natural drainage."

Secondary-Recovery Costs

A. C. Simmons, geologist and petroleum engineer, presented an exhaustive analysis of procedures for estimating costs on secondary water-flood developments to dispel some of the illusions relating costs to depth and oil recovery. The land or oil right cost, being a fixed item, the cost per barrel will vary with recoveries obtained.

Frequently development costs are estimated on an approximate basis of depth comparisons, he said, when it should be obvious that the cost of surface equipment and installations depends on quantities of fluid to be handled and horsepower requirements per unit of area and is absolutely independent of the depth of the producing formation. Operating costs are too frequently projected on a per-barrel basis and considered directly proportional to the oil recovery per acre when actually they should be estimated on a per-acre basis or projected into the future on the basis of cost per month or per year.

S. T. Yuster and J. C. Calhoun, of Pennsylvania State College, discussed methods of reducing the over-all conductivity of the higher permeability strata to cut down excessive water handling and to permit flooding of strata of lower permeability. The characteristics and limitations of numerous techniques that have been tried with varying degrees of success were discussed as was a new agent developed at the college. This treating compound, a colloidal dispersion of a solid in water, has been successful in laboratory tests and has shown promising results in field tests.

One of the most interesting contributions to the secondary-recovery symposium was the paper by R. B. Bossler of Brundred Oil Corp. on flowing producing wells in secondary recovery. His paper discussed flowing operations both in water flood and air or gas repressuring areas operated by the company. Discussing reasons for and against flowing, he said that, from an economic standpoint, it is obvious that investment and operating costs should be lower but the lifetime of the flood will probably be longer, capital may not be returned as rapidly, and the ultimate recovery may be somewhat smaller. Peak productions are not so high and production is better distributed when flowing with the result that federal taxes may be a less serious problem.

Application of laboratory data to field practices was discussed in a paper by Harry Ryder and presented by David Scott, Jr., both of Ryder-Scott Co. This paper pointed out the variations that may occur in a water-flood development and how operations should be adjusted to compensate for these variations to obtain the greatest yields with the minimum costs.

An explanation of laboratory tests on oil sands in connection with secondary recovery and the application of the results opened the section of secondary-recovery methods. Explanations and demonstrations of the tests were given by Paul Phillipi, Forest Oil Co., on porosity; Donald May, Ryder Scott Co., on saturation, and John DePetro, Simmons Oil Corp., on permeability.

Arrangements for the meeting were made by this group: (back row) Cornell Pfohl, Kendall Refining Co.; D. T. Andrus, Andrus & McDowell; C. E. Streeter, Carter, Bradley & Streeter; H. J. Walter, H. J. Walter Oil Co.; John W. Bryner, Minard Run Oil Co.; W. J. Sloan, Sloan & Zook Co.; G. G. Bauer, Bradford District Producers Association; William Shoemaker, Forest Oil Corp., and Oscar Carlson, South Penn Oil Co. Front row: P. L. Melvin, Towne-Melvin Oil Co.; A. C. Simmons, Simmons Oil Corp., cochairman; J. P. Jones, Otto Oil Co., chairman; Raymond Brennan, Eastern Royalties, Inc., and David Scott, Jr., Ryder-Scott Co.

A.I.M.E. Oil Technologists To Meet in Houston

HOUSTON.—A joint regional meeting of the American Institute of Mining and Metallurgical Engineers and the annual spring meeting of the Petroleum Division of the A.I.M.E. will be held at the Rice Hotel, May 8-10.

Following is the program of the petroleum sessions:

Tuesday, May 9, 9:30 A.M.

"Bureau of Mines Flow Tests on Gas Condensate Wells," by R. E. Heithecker and Kenneth Eilerts, U. S. Bureau of Mines.

"Analysis of Material Balance Calculations," by Morris Muskat, Gulf Research & Development Co.

"Factors Involved in Estimating Results of Pressure-Maintenance Programs," by L. E. Elkins and A. W. Walker, Stanolind Oil & Gas Co.

"Recent Trends in Kansas Petroleum Economics," by Joseph A. Kornfeld.

Tuesday, May 9, 2 P.M.

"Behavior of Shut-In Wells," by P. T. Amstutz, Jr., and E. A. Stephenson, University of Kansas.

"Application of the Electric Pilot to Well Completions, Acidizing and Production Problems in the Permian Basin," by Phil S. Lehnhard and C. J. Cecil, Dowell, Inc.

"An Introductory Discussion of the Reservoir Performance and Limestone Formations," by A. C. Bulnes and R. N. Fitting, Shell Oil Co., Inc.

"Production Decline in Limestone Fields of Mexico," by Paul Weaver, Gulf Oil Corp.

Wednesday, May 10, 9.30 A.M.

"Decline Curve Analysis," by J. J. Arps, British-American Oil Producing Co.

"Significance of Declining Productivity Indices," by C. V. Millikan, Amerada Petroleum Corp., and H. F. Beardmore, Barnsdall Oil Co.

"Color Tests in Core Analysis," by E. R. Philipp, Atlantic Refining Co.

"Experimental Determinations of the Water Vapor Content of Natural Gas Up to 2,000 Lbs. Pressure," by R. L. Huntington, University of Oklahoma.

Wednesday, May 10, 2 P.M.

"Use of Modified Starch in Gulf Coast Drilling Mud," by G. R. Gray, Baroid Sales Division, National Lead Co.

"Positive Colloid Muds for Drilling Through Heaving Shale," by D. C. Bond, Pure Oil Co.

"Well Cementing," by Ray S. Kail, Baker Oil Tools, Inc., and B. C. Craft, Louisiana State University.

"The Quantitative Approach in Petroleum Engineering," by H. H. Power, University of Texas.

Program for Natural Gas Conference Announced

NEW YORK.—The tentative program for the spring conference of Natural Gas Section, American Gas Association, to be held May 11-13 in French Lick Springs Hotel, French Lick, Ind., announced from the headquarters in New York, forecasts an interesting 3-day session. With one speaker still to be decided upon, it follows:

THURSDAY, MAY 11

10:00 A.M.

Opening remarks—Maj. Alexander Forward, managing director, American Gas Association, New York.

President's greeting—Ernest R. Acker, president, American Gas Association, New York.

Remarks—R. E. Wertz, past chairman, Natural Gas Section, Amarillo, Tex.

Chairman's address—J. French Robinson, chairman, Natural Gas Section.

"Natural Gas Research, Its Importance and Possibilities"—Dr. R. R. Sayers, director, U. S. Bureau of Mines, Washington.

"Education and the Industry"—Dr. Charles E. Lawall, president, West Virginia University.

2:30 P.M.

"Purification of Natural Gas Having Large Sulphur Content"—C. W. Cooper, vice president, Consolidated Natural Gas Co., New York.

"Natural Gas Cycling and Its Significance to Natural Gas Industry"—Dr. Frank H. Dotterweich, associate professor, Texas College of Arts and Industries.

"Our Natural Gas Resources"—Lyon F. Terry, second vice president, Chase National Bank, New York.

"Data Obtained in Bureau of Mines Flow Tests on Gas-Condensate for Wells" (illustrated with slides)—Kenneth Eilerts, physical chemist, Petroleum and Natural Gas Division, U. S. Bureau of Mines, Bartlesville, Okla.

FRIDAY, MAY 12

9:30 A.M.

Symposium on Natural-Gas Storage

Leader, J. French Robinson

"Liquefaction of Natural Gas"—Charles F. Turner, chief chemist, The East Ohio Gas Co., Cleveland, Ohio.

Underground Storage of Natural Gas, Appalachian Area

1. F. H. Finn, chief geologist, The Peoples Natural Gas Co., Pittsburgh. (In collaboration with J. B. Corrin, Hope Natural Gas Co., and J. J. Schmidt, The East Ohio Gas Co.)
2. George S. Young, vice president, Columbia Engineering Corp., New York.
3. J. H. Isherwood, vice president and general manager, North Penn Gas Co., Port Allegany, Pa.
4. J. R. Reeves, general superintendent (natural gas), Republic Light, Heat & Power Co., Inc., Buffalo, N. Y.
5. J. Hawker Newlon, superintendent of production and geologist, The Equitable Gas Co., Pittsburgh.

2:30 P.M.

Underground Storage of Natural Gas, Other Areas

1. M. L. Fort, superintendent, compressor plant and pipe-line operations, Pacific Lighting Corp., Los Angeles.
2. C. W. Studt, production engineer, Union Gas System, Inc., Independence, Kans.
3. W. R. Kubista, engineer, Oklahoma Natural Gas Co., Tulsa.
4. Frank D. Howell, general superintendent, Dominion Natural Gas Co., Ltd., Brantford, Ont.
5. P. D. Mellon, general superintendent and chief engineer, Canadian Western Natural Gas, Light, Heat & Power Co., Ltd., Calgary, Alta.

Summary—E. G. Dahlgren, technical secretary, research and coordinating committee, Interstate Oil Compact Commission, Oklahoma City.

"Accounting Practices Employed in Underground Storage"—F. B. Flahive, comptroller, Columbia Gas & Electric Corp., New York.

8:30 P.M.

"A Gas Man at the Front in Africa and Italy" (illustrated with movies)—Capt. E. M. Borger, American Field Service; president, The Peoples Natural Gas Co., Pittsburgh.

SATURDAY, MAY 13

9:30 A.M.

Symposium of Long-Distance Transmission of Natural Gas

Leader, Robert W. Hendee, president, Colorado Interstate Gas Co., Colorado Springs.

1. Pipe Line

1. R. G. Strong, superintendent of pipe lines, Natural Gas Pipeline Co. of America, Chicago.
2. D. K. Stephens, transmission pipe-line superintendent, Panhandle Eastern Pipe Line Co., Kansas City.
3. John A. Clark, chief engineer, Hope Natural Gas Co., Clarksburg, W. Va. (In collaboration with George W. McKinley.)
4. (Speaker to be announced), Tennessee Gas & Transmission Co., Houston.
5. E. R. Cunningham, general superintendent main pipe lines, United Gas Pipe Line Co., Shreveport.
6. A. W. Sommerville, assistant to president and manager, Mississippi River Fuel Corp., St. Louis.

2. Compressing Station

1. M. C. Madsen, chief engineer, Northern Natural Gas Co., Omaha, Neb. (In collaboration with John B. Stewart, chief engineer.)
2. G. F. Brunston, chief engineer, Colorado Interstate Gas Co., Colorado Springs.

3. Dehydration Plants

1. T. S. Bacon, research engineer, Lone Star Gas Co., Dallas.
2. H. J. Carson, vice president, Northern Natural Gas Co., Omaha, Neb.
3. (Speaker to be announced), United Gas Pipe Line Co., Shreveport.
4. E. G. Hammerschmidt, chief chemist, Texoma Natural Gas Co., Fritch, Tex.

DEATHS

H. H. Champlin, 76, president and general manager of Champlin Refining Co., Enid, Okla., died April 30. He was president of First National Bank, which he established in Enid shortly after the opening of the Cherokee strip in 1893. He recently was elected a delegate to the Republican national convention.

Dr. Charles M. Ives, 62, physician of Humble Oil & Refining Co. since 1919, died April 25 in Houston.

Albert E. Manley, 68, for 30 years an executive of The Texas Co., died April 23 in Bayonne, N. J. At the time of his retirement in 1941 he was general superintendent of terminals in that city.

Harry Adams, 75, retired oil man, died April 24 in Houston.

Andrew P. Coombe, 79, for 20 years president of Standard Oil Co. of Ohio until his retirement in 1928, died April 27 in Cleveland, Ohio. He was associated with Standard of Ohio 44 years and was in charge of Standard Oil interests in Mexico 10 years.

Harry T. McLaughlin, 65, chief engineer in the distribution division of Lone Star Gas Co., died in Dallas April 26.

Harvey P. Elwood, superintendent of Humble Oil & Refining Co.'s gasoline plant at Dickinson, Tex., died April 27. He had been with Humble 20 years.

Frederick H. Herpst, retired employe of South Penn Oil Co., died April 28 in Buffalo, N. Y.

George W. White, 52, independent oil operator, died of a heart attack April 23 in Fort Worth. He had interests in the Smackover field, Arkansas, and in fields of Oklahoma, East Texas and West Texas.

Suspensoid Catalytic Cracking System Gives Nearly 60 Per Cent Gasoline Yield

by Arch L. Foster

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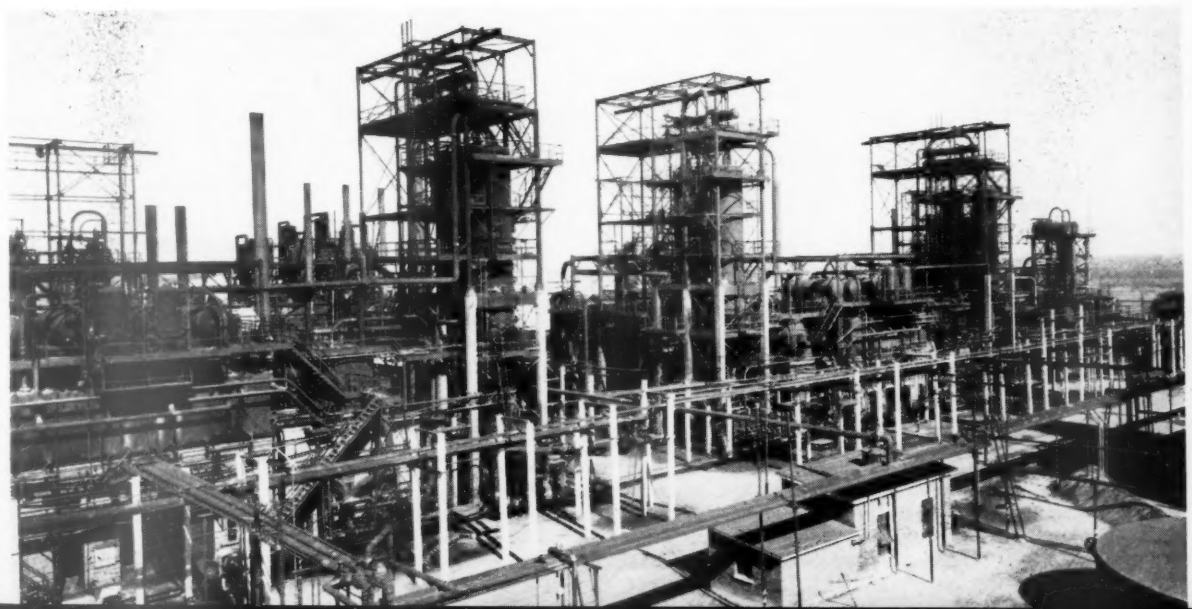

A.I.M.E. Oil Technologists To Meet in Houston

HOUSTON.—A joint regional meeting of the American Institute of Mining and Metallurgical Engineers and the annual spring meeting of the Petroleum Division of the A.I.M.E. will be held at the Rice Hotel, May 8-10.

Following is the program of the petroleum sessions:

Tuesday, May 9, 9:30 A.M.

"Bureau of Mines Flow Tests on Gas Condensate Wells," by R. E. Heithecker and Kenneth Eilerts, U. S. Bureau of Mines.

"Analysis of Material Balance Calculations," by Morris Muskat, Gulf Research & Development Co.

"Factors Involved in Estimating Results of Pressure-Maintenance Programs," by L. E. Elkins and A. W. Walker, Stanolind Oil & Gas Co.

"Recent Trends in Kansas Petroleum Economics," by Joseph A. Kornfeld.

Tuesday, May 9, 2 P.M.

"Behavior of Shut-In Wells," by P. T. Amstutz, Jr., and E. A. Stephenson, University of Kansas.

"Application of the Electric Pilot to Well Completions, Acidizing and Production Problems in the Permian Basin," by Phil S. Lehnhard and C. J. Cecil, Dowell, Inc.

"An Introductory Discussion of the Reservoir Performance and Limestone Formations," by A. C. Bulnes and R. N. Fitting, Shell Oil Co., Inc.

"Production Decline in Limestone Fields of Mexico," by Paul Weaver, Gulf Oil Corp.

Wednesday, May 10, 9.30 A.M.

"Decline Curve Analysis," by J. J. Arps, British-American Oil Producing Co.

"Significance of Declining Productivity Indices," by C. V. Millikan, Amerada Petroleum Corp., and H. F. Beardmore, Barnsdall Oil Co.

"Color Tests in Core Analysis," by E. R. Philipp, Atlantic Refining Co.

"Experimental Determinations of the Water Vapor Content of Natural Gas Up to 2,000 Lbs. Pressure," by R. L. Huntington, University of Oklahoma.

Wednesday, May 10, 2 P.M.

"Use of Modified Starch in Gulf Coast Drilling Mud," by G. R. Gray, Baroid Sales Division, National Lead Co.

"Positive Colloid Muds for Drilling Through Heaving Shale," by D. C. Bond, Pure Oil Co.

"Well Cementing," by Ray S. Kail, Baker Oil Tools, Inc., and B. C. Craft, Louisiana State University.

"The Quantitative Approach in Petroleum Engineering," by H. H. Power, University of Texas.

Program for Natural Gas Conference Announced

NEW YORK.—The tentative program for the spring conference of Natural Gas Section, American Gas Association, to be held May 11-13 in French Lick Springs Hotel, French Lick, Ind., announced from the headquarters in New York, forecasts an interesting 3-day session. With one speaker still to be decided upon, it follows:

THURSDAY, MAY 11

10:00 A.M.

Opening remarks—Maj. Alexander Forward, managing director, American Gas Association, New York.

President's greeting—Ernest R. Acker, president, American Gas Association, New York.

Remarks—R. E. Wertz, past chairman, Natural Gas Section, Amarillo, Tex.

Chairman's address—J. French Robinson, chairman, Natural Gas Section.

"Natural Gas Research, Its Importance and Possibilities"—Dr. R. R. Sayers, director, U. S. Bureau of Mines, Washington.

"Education and the Industry"—Dr. Charles E. Lawall, president, West Virginia University.

2:30 P.M.

"Purification of Natural Gas Having Large Sulphur Content"—C. W. Cooper, vice president, Consolidated Natural Gas Co., New York.

"Natural Gas Cycling and Its Significance to Natural Gas Industry"—Dr. Frank H. Dotterweich, associate professor, Texas College of Arts and Industries.

"Our Natural Gas Resources"—Lyon F. Terry, second vice president, Chase National Bank, New York.

"Data Obtained in Bureau of Mines Flow Tests on Gas-Condensate for Wells" (illustrated with slides)—Kenneth Eilerts, physical chemist, Petroleum and Natural Gas Division, U. S. Bureau of Mines, Bartlesville, Okla.

FRIDAY, MAY 12

9:30 A.M.

Symposium on Natural-Gas Storage

Leader, J. French Robinson

"Liquefaction of Natural Gas"—Charles F. Turner, chief chemist, The East Ohio Gas Co., Cleveland, Ohio.

Underground Storage of Natural Gas, Appalachian Area

1. F. H. Finn, chief geologist, The Peoples Natural Gas Co., Pittsburgh. (In collaboration with J. B. Corrin, Hope Natural Gas Co., and J. J. Schmidt, The East Ohio Gas Co.)

2. George S. Young, vice president, Columbia Engineering Corp., New York.

3. J. H. Isherwood, vice president and general manager, North Penn Gas Co., Port Allegany, Pa.

4. J. R. Reeves, general superintendent (natural gas), Republic Light, Heat & Power Co., Inc., Buffalo, N. Y.

5. J. Hawker Newlon, superintendent of production and geologist, The Equitable Gas Co., Pittsburgh.

2:30 P.M.

Underground Storage of Natural Gas, Other Areas

1. M. L. Fort, superintendent, compressor plant and pipe-line operations, Pacific Lighting Corp., Los Angeles.

2. C. W. Studt, production engineer, Union Gas System, Inc., Independence, Kans.

3. W. R. Kubista, engineer, Oklahoma Natural Gas Co., Tulsa.

4. Frank D. Howell, general superintendent, Dominion Natural Gas Co., Ltd., Brantford, Ont.

5. P. D. Mellon, general superintendent and chief engineer, Canadian Western Natural Gas, Light, Heat & Power Co., Ltd., Calgary, Alta.

Summary—E. G. Dahlgren, technical secretary, research and coordinating committee, Interstate Oil Compact Commission, Oklahoma City.

"Accounting Practices Employed in Underground Storage"—F. B. Flahive, comptroller, Columbia Gas & Electric Corp., New York.

8:30 P.M.

"A Gas Man at the Front in Africa and Italy" (illustrated with movies)—Capt. E. M. Borger, American Field Service; president, The Peoples Natural Gas Co., Pittsburgh.

SATURDAY, MAY 13

9:30 A.M.

Symposium of Long-Distance Transmission of Natural Gas

Leader, Robert W. Hendee, president, Colorado Interstate Gas Co., Colorado Springs.

1. Pipe Line

1. R. G. Strong, superintendent of pipe lines, Natural Gas Pipeline Co. of America, Chicago.

2. D. K. Stephens, transmission pipe-line superintendent, Panhandle Eastern Pipe Line Co., Kansas City.

3. John A. Clark, chief engineer, Hope Natural Gas Co., Clarksburg, W. Va. (In collaboration with George W. McKinley.)

4. (Speaker to be announced), Tennessee Gas & Transmission Co., Houston.

5. E. R. Cunningham, general superintendent main pipe lines, United Gas Pipe Line Co., Shreveport.

6. A. W. Sommerville, assistant to president and manager, Mississippi River Fuel Corp., St. Louis.

2. Compressing Station

1. M. C. Madsen, chief engineer, Northern Natural Gas Co., Omaha, Neb. (In collaboration with John B. Stewart, chief engineer.)

2. G. F. Brunston, chief engineer, Colorado Interstate Gas Co., Colorado Springs.

3. Dehydration Plants

1. T. S. Bacon, research engineer, Lone Star Gas Co., Dallas.

2. H. J. Carson, vice president, Northern Natural Gas Co., Omaha, Neb.

3. (Speaker to be announced), United Gas Pipe Line Co., Shreveport.

4. E. G. Hammerschmidt, chief chemist, Texoma Natural Gas Co., Fritch, Tex.

DEATHS

H. H. Champlin, 76, president and general manager of Champlin Refining Co., Enid, Okla., died April 30. He was president of First National Bank, which he established in Enid shortly after the opening of the Cherokee strip in 1893. He recently was elected a delegate to the Republican national convention.

Dr. Charles M. Ives, 62, physician of Humble Oil & Refining Co. since 1919, died April 25 in Houston.

Albert E. Manley, 68, for 30 years an executive of The Texas Co., died April 23 in Bayonne, N. J. At the time of his retirement in 1941 he was general superintendent of terminals in that city.

Harry Adams, 75, retired oil man, died April 24 in Houston.

Andrew P. Coombe, 79, for 20 years president of Standard Oil Co. of Ohio until his retirement in 1928, died April 27 in Cleveland, Ohio. He was associated with Standard of Ohio 44 years and was in charge of Standard Oil interests in Mexico 10 years.

Harry T. McLaughlin, 65, chief engineer in the distribution division of Lone Star Gas Co., died in Dallas April 26.

Harvey P. Elwood, superintendent of Humble Oil & Refining Co.'s gasoline plant at Dickinson, Tex., died April 27. He had been with Humble 20 years.

Frederick H. Herpst, retired employe of South Penn Oil Co., died April 28 in Buffalo, N. Y.

George W. White, 52, independent oil operator, died of a heart attack April 23 in Fort Worth. He had interests in the Smackover field, Arkansas, and in fields of Oklahoma. East Texas and West Texas.

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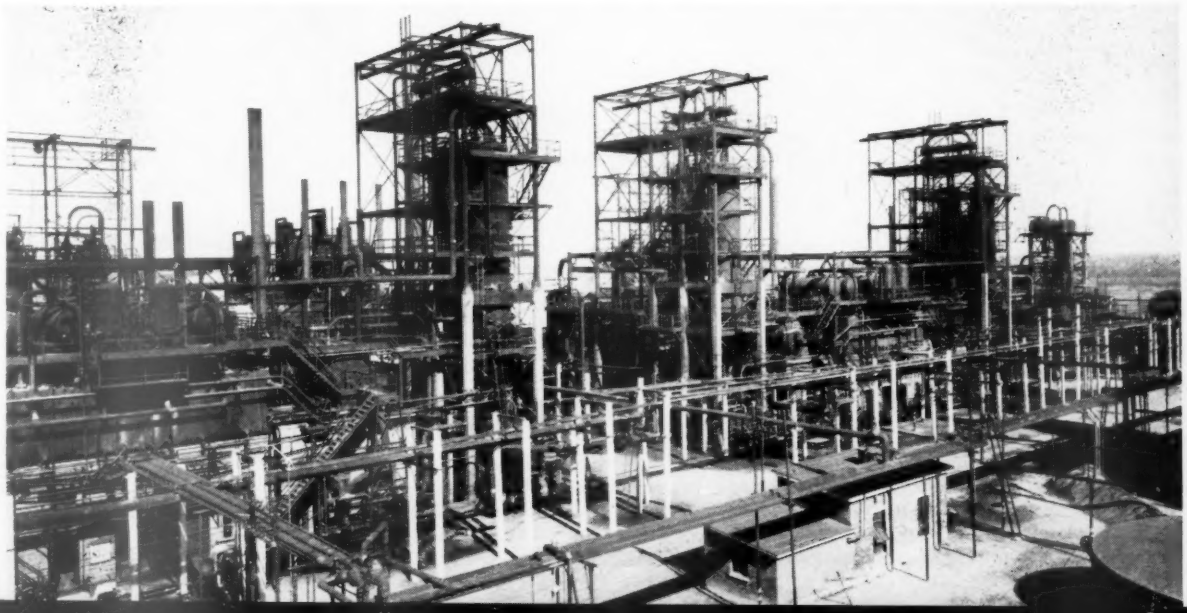
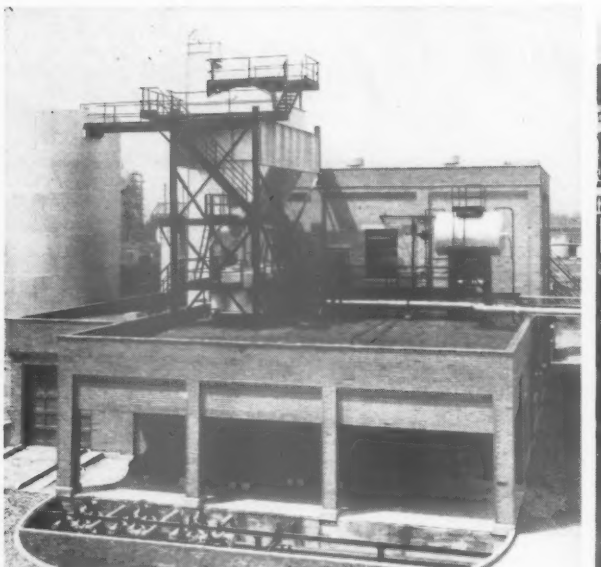




Catalyst bins and elevating and mixing equipment

Handling pumps of Suspensoid catalytic-cracking system

mal methods employed. This article is not to be a resume of what was done to reach the present status of operations, but to summarize briefly what is now being done to crack oil catalytically, the result of those years of study and experimentation. United States and Canadian patents have been obtained to cover various features of the operation.

The present system operating at the Imperial refinery utilizes most of the equipment in these four tube-and-tank units. Early the principle of mixing the catalyst as a slurry directly with the charge stock, was adopted and is still used. To the original cracking units was added clay-storage capacity in the form of steel cone-bottomed clay hoppers, elevated above the slurry mixing level. Slurry tanks with stirring equipment were provided as discussed later; special clay pumps to handle the slurry and the discarded catalyst; and the several metering devices, piping, valves, etc., required for the cracking cycle. For handling spent catalyst are provided a special pump to meet the peculiar demands of that job, three special pressure precoat Oliver rotary filters for recovering the spent catalyst; screw conveyor and bucket elevator for handling recovered catalyst; and the necessary bins, accessory piping, etc.

The cracking units themselves, as stated earlier, are conventional, generally speaking, including preheaters, convection and radiant coils, soaking drum or "tank," flash chamber and fractionation-condensation equipment. Each is served by a tandem gas-engine-driven hot-oil pump of National Transit design, well known in the United States, also for this purpose. In the radiant section of the heater plain carbon steel tubes have been used except for the last tube unit in which 4-6 per cent chrome, ½ per cent molybdenum tubes have given excellent service, operating on Mid-Continent and Illinois crudes, such as Louden.

Briefly, the process is operated as follows: Filtrol, which at Sarnia is spent Filtrol from the lubricating-oil clay-contact plant, or similar clay of 100 per cent through 100 mesh, is brought into the plant by rail or truck and is dumped into a bin of 37 tons capacity, from which a bucket conveyor lifts a portion upward and dumps it into a cone-bottomed bin. Immediately below this bin is a slurry tank, into which flows a measured amount of clay; from the tank a measured amount of charge stock—gas oil—is pumped, the stirring mechanism is started and a slurry is made which can be pumped into the system. In actual practice this operation is continuous, synchronized with the main charge to the cracking units. The amount of clay is so supplied at present that the content of catalyst in the charge to the coils is about 2 lb. per bbl. of feed although different percentages have been used.

The main body of the charge stock, consisting of about 75 per cent of light, intermediate and heavy gas oils to which is added 25 heavy naphtha, is pumped from storage through preheater exchangers where it is preheated in exchange with cracked gas oil or other hot fractions, is picked up by the hot-oil pumps and sent to the heaters. On the way this hot charge is mixed continuously and proportionately with the catalyst slurry just before the mixture enters the heating coil. The preheat temperature may vary depending on conditions but 500°-550° F. is a typical average value as the charge-catalyst slurry enters the coils. The heavy naphtha diluent is added to reduce the partial pressure and to insure complete vaporization of the total charge during the cracking cycle.

The combined charge is heated to 1,040°-1,060° F. in the coil, under 400-500 lb. per sq. in. and is discharged through a transfer line directly into the flash chamber, a part of the original cracking-unit assembly. The charge is quenched with cracked gas oil to about 750° F. at the coil outlet. This requires normally about 35-40 per cent of gas oil, based on feed stock, to obtain the desired quenching effect. Vapors from the flash chamber are fractionated in two conventional nine-plate towers to the desired specification. the distillation range being dependent on the purpose to which the distillate is put. The fractionator bottoms are usable as furnace oil or relatively low-cetane diesel fuel.

Table 1 shows typical yields and properties of products of this operation.

Tar and Catalyst Disposal

The unvolatilized tar-catalyst mixture left in the bottom of the flash chamber flows to a receiver column alongside the catalyst-recovery unit. From this receiver the heavy slurry, maintained at 450°-500° F. or higher temperature to increase fluidity, flows to three precoat Oliver pressure rotary filters for removal of the catalyst from the tar. The filters operate as pressure filters on the well-known rotary principle and consist of

TABLE 1—YIELDS AND PROPERTIES OF THERMALLY CRACKED AND SUSPENSOID CATALYTICALLY CRACKED GASOLINES FROM HEAVY NAPHTHA PLUS GAS OIL FEED STOCKS

	Exclusive of polymer		Including nonselective polymer	
	Thermal reforming and cracking	Suspensoid cat. cracking	Thermal reforming and cracking	Suspensoid cat. cracking
Yields:				
Gasoline, 400° F. end point, 10-lb. R.V.P.	56.1	52.3	58.3	58.6
Excess butanes and butylenes	1.3	4.5	Nil	Nil
Heating oil	12.7	12.7	12.7	12.7
Fuel oil, 10° A.P.I.	25.6	20.2	25.6	20.2
Dry gas, weight, per cent	6.7	12.5	5.9	10.5
Gasoline quality, 10-lb. R.V.P., 400° F. end point:				
A.S.T.M. octane number, clear	65.4	73.2	66.6	75.5
Research '39, octane number, clear	71.0	82.0	72.6	85.1
1 cc. TEL	79.0	87.3	80.1	89.7
3 cc. TEL	84.8	91.4	85.6	93.2
Olefin content (gas volume, per cent):				
Of the propane-propylene cut		47%		
Of the butane-butylene cut		58%		

a revolving drum surfaced with a filter pad on which is built up a layer of fine-grained filter medium 1-in. or more thick. As this drum rotates slowly, its surface passing alternately underneath the surface of the hot, fluid tar-catalyst slurry and rising above that level to remove the tar from the layer of catalyst deposited thereon, a thin knife edge shears away a very thin layer of this precoat and its deposit, which layer is dumped into a screw conveyor. A pressure of 15-20 lb. per sq. in. is maintained inside the filter jacket by means of flue gas and this flue gas atmosphere is held above the hot tar all the way through the process of catalyst recovery and disposal. This precoat layer will permit continuous operation of the filter for 50-60 hours before a new coat must be deposited.

The tar (10°-12° A.P.I.) which, after filtration, is of excellent quality, is removed from the system to be utilized as fuel oil in the plant, as a constituent of salable fuel oil or in the manufacture of asphalt as the refinery management may choose. The spent catalyst, very dark in color, is carried by a screw conveyor outside the building, is dumped into and picked up by a second screw conveyor, carried at right angles and dumped into a balanced cone-bottomed hopper. When a given weight of catalyst is dumped into this balanced hopper it swings downward, trips a special pump which discharges the catalyst into a conveyor below, from which a bucket conveyor hoists it overhead and dumps it in turn into railroad cars which cart it away to be dumped into waste land some distance away.

Eventual plans are for a clay burning system to regenerate the catalyst, a step which is necessary if the process is to operate economically at plants that have no spent clay from a lubricating clay contact plant available. Such a system has not been installed at Sarnia for several reasons, among them being the inability to obtain the needed equipment under war priorities. Opinion of Imperial's technologists is that a very small unit employing a modification of fluid-catalyst regenerating technique will be entirely satisfactory for their purpose, when peace returns and construction time and equipment are both available.

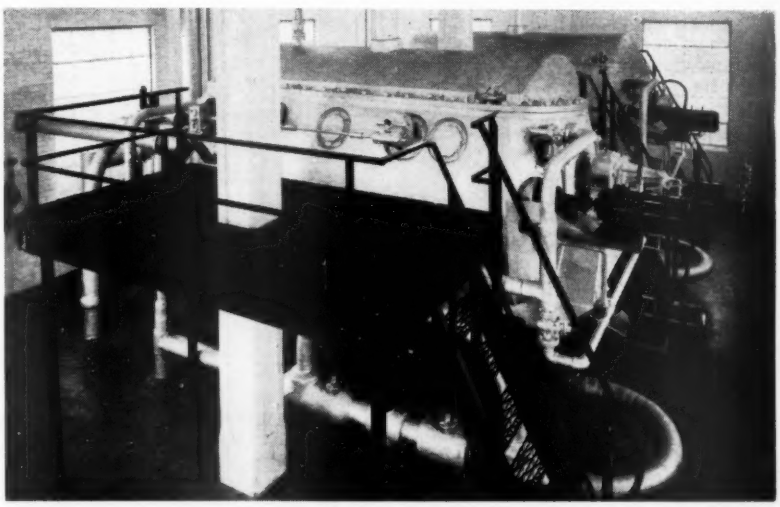
Coil Erosion Mild

One of the first difficulties which the uninitiated look for in this type of operation is severe erosion of equipment, especially in tubes and headers, and pressure release valves. Imperial's technologists state the erosion of heater tubes, both carbon steel and low chrome alloys, is very little greater under these conditions of temperature and pressure than it was when operating under thermal cracking conditions of 1,000 lb. per sq. in. and 900°-1,000° F. This refers to operations on Mid-Continent and Illinois crudes which are processed by the refinery. Another singular fact is that, at lower pressures such as 200 lb. per sq. in. or somewhat higher, serious erosion may appear.

The matter of a pressure release valve, beyond the heater coils, which would withstand the wear of the abrasive clay passing through it, plagued the system for some time. It was finally solved by the installation of a small converging orifice made of carbon steel discharging immediately into the flash chamber. The mixture, when flashed, expands directly into the chamber; there the clay does not travel through a length of restricted cross-section conduit, and thus cannot erode metal except for the instant of passing through the restricted orifice. In this manner the desired back pressure is maintained on the heating coil with a minimum of wear on tubes and headers.

Another problem which has been solved practically is that of a combination of leaks at packing glands on the spent catalyst filters. Some leakage of hot tar and oils still occurs but it has been reduced to small proportions and the clay is kept out of the bearing surfaces by a special gland arrangement through which clean oil flows continuously.

The rush to maintain production of war-vital aviation and other fuels has prevented study and experimentation to determine the limits of practicability of the suspensoid process, and the optimum conditions for obtaining the maximum yields of product and product quality. As pointed out, the operators have determined a good set of conditions for making what is so necessary to the war program and full-scale operations continue along that line. When peace permits it is planned to vary operations widely over a great range of conditions and to explore the process to find out the best that may be obtained from it.



Oliver precoat filters, used to remove the spent catalyst from the tarry residual oil from the cracking unit. Additional filter capacity has been installed at the plant since picture was taken

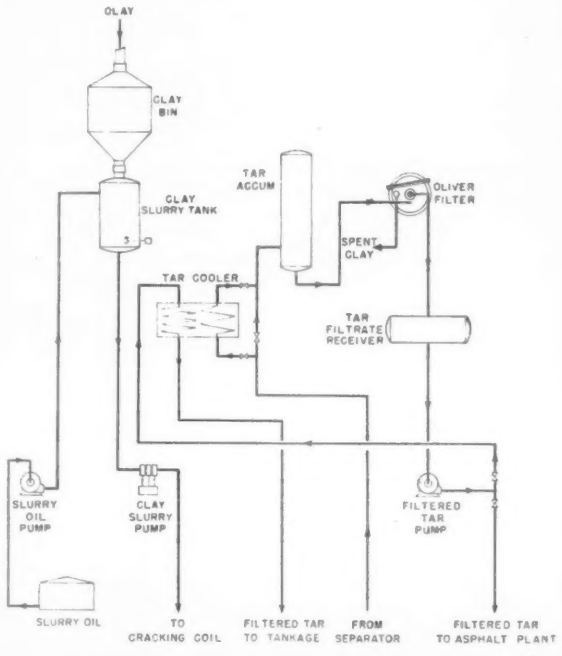
The alpha and omega of the Suspensoid catalyst system. The taller covered elevator at right center conveys the fresh catalyst to the bins and mixing system, entering the unit. The shorter conveyor in front center carries the spent catalyst from the dump bin below overhead to discharge into cars for disposal or regeneration. The conical container below the piping is the weighing bin to measure the catalyst coming from the system

For example, it has been determined that mixing more than the standard 2 lb. per bbl. of catalyst with the charge does improve the A.S.T.M. octane number somewhat. However, economics of using more clay has not been developed and it is unlikely that this phase of the operation will be explored properly for the duration.

Another fact which has not been adequately explored as yet is the actual octane number of the cracked distillate from the gas oil charge without the dilution of the straight-run naphtha which is used to dilute the charge. The octane number of this diluent naphtha is of the order of 40-50 or less, A.S.T.M. method. So far as can be determined this naphtha is reformed only to the normal extent of about 70-72 A.S.T.M. octane number during the process under the conditions employed. Since up to 25 per cent naphtha is added to the charge, it seems indubitable that the actual octane number of the cracked distillate itself is increased from 73.2 for the mixture to 75 for the naphtha-free cracked gasoline. As stated before, this naphtha is added to reduce the partial pressure of the gas-oil-type charge stock to insure complete vaporization of the charge. Dr. Stratford, who has directed the research on this interesting process since its inception, states that apparently the catalytic effect in cracking, giving higher octane number and other desirable properties which are characteristic of catalytically cracked gasoline, is not obtained in the presence of this catalyst by this process unless the charge is in the vapor phase during the cracking reaction. It appears to be quite practicable to dilute this charge stock with a light, high-octane-number naphtha and thus obtain a decided increase in octane number of the final product. Reforming the heavy naphtha thermally or catalytically would bring up its octane number correspondingly, and the average rating of the three products blended would be thus improved importantly.

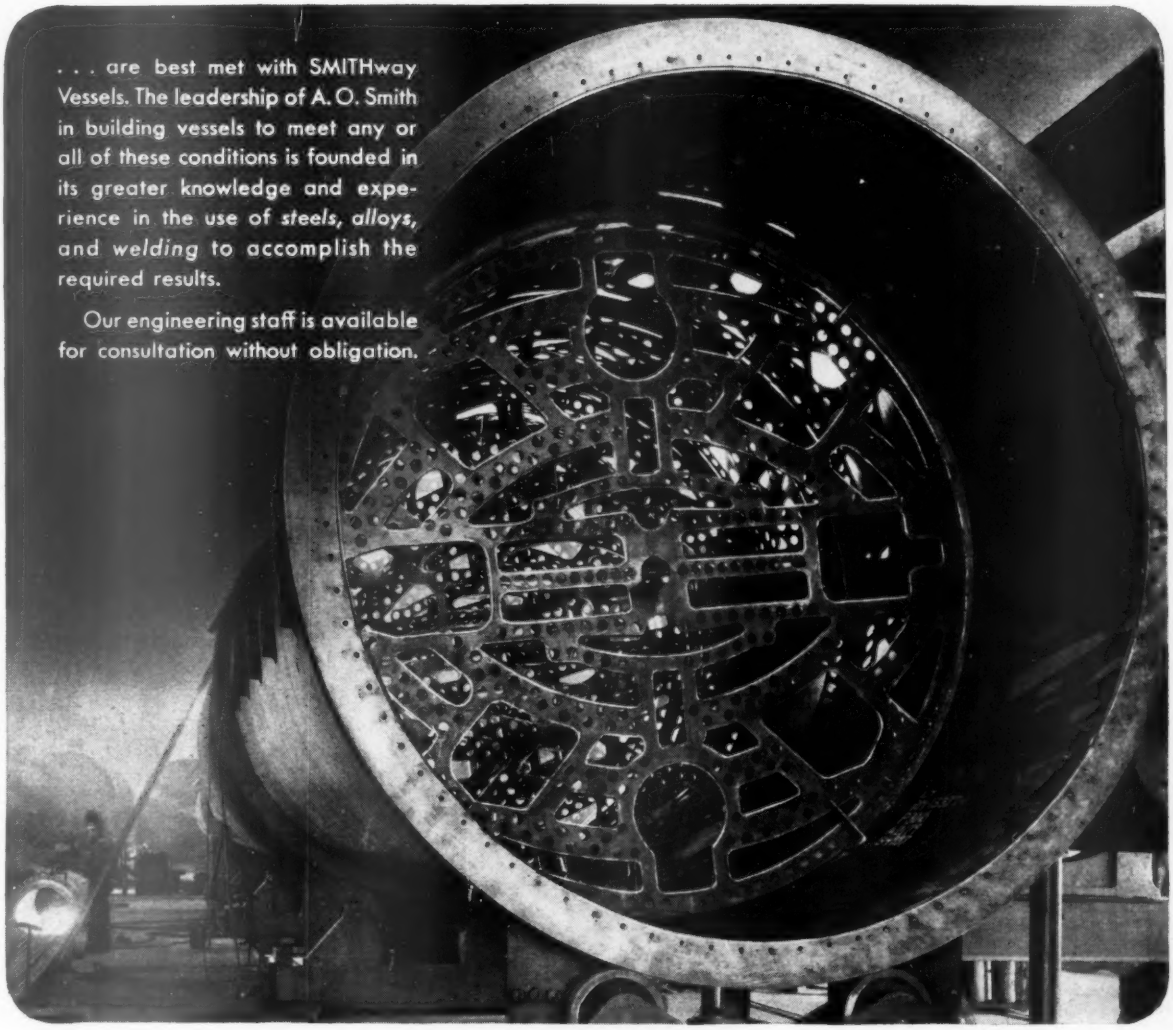
The soaking drum in the original tube-and-tank system was used at first as a soaking zone for the catalytic reaction. However, the slowing down of motion in the dilute slurry deposited catalyst masses to form "niggerheads" in the soaker, necessitating shutting down the unit frequently for clean-outs. Experimental work on suspensoid cracking has been going on for more than 10 years. All the work carried out was on plant equipment. It has been definitely proved that small quantities of clay have a marked catalytic effect upon the cracked gasoline produced. Complete vaporization, which means a temperature well above the so-called dew point, is absolutely essential, as otherwise the clay cokes very readily and as a result loses its activity. The best results have been obtained using the lowest temperature and the longest time at cracking temperatures that insure complete vaporization of the high-boiling components in the system.

It can be seen, therefore, that a system of injecting, cracking with, and removing, small quantities of a catalyst from an oil, has been developed to a point where it is a commercially practical operation.



Flow diagram catalyst-handling equipment. Suspensoid operation

Conditions Involving High PRESSURES High TEMPERATURES and CORROSION . . .



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South Arkansas Operators Employ Innovations in Drilling Procedures

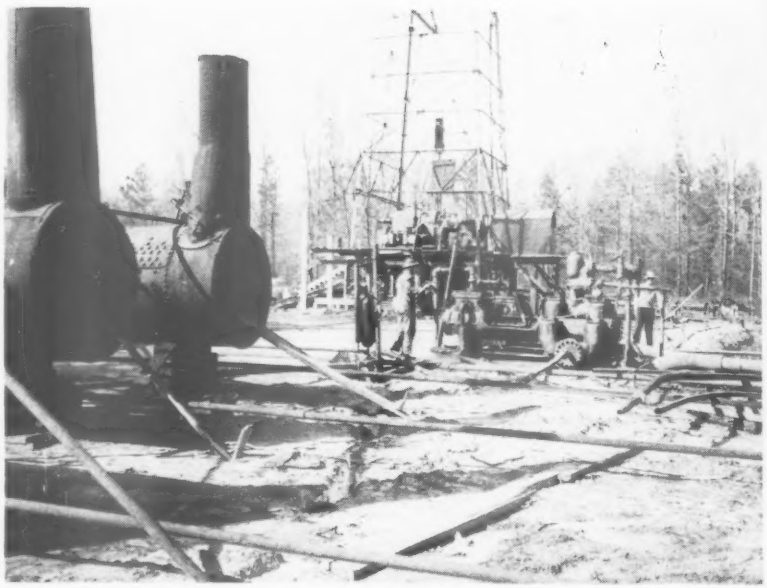
by Paul Reed

IN conducting drilling operations in the fields of South Arkansas, practices for the particular requirements of the area, as well as innovations in standard procedures, have been developed which may have applications elsewhere. At present, attention is being directed principally to the Dorcheat-Macedonia pool where most wells are drilled to the Smackover lime at depths of 8,600 to 8,800 ft. subsea where two-thirds of the reserves of the pool are found; an additional objective is to obtain production by dual completion from the Cotton Valley sandstone lenses from 6,500 to 8,200 ft. subsea containing the remainder of reserves.

Reservoir pressures in the Cotton Valley sands range from 2,600 to 3,600 lb. per sq. in. where lenses produce either a sweet gas and condensate, with gas-oil ratios up to 20,000 cu. ft. per bbl., or 42° gravity crude oil with low gas-oil ratios. From the oolitic-to-chalky Smackover formation sour gas and condensate with gas-oil ratios up to 20,000 cu. ft. per bbl. are produced with reservoir pressure of 3,210 lb. per. sq. in.

The most troublesome difficulties encountered in drilling in the area arise from the effect of massive anhydrite found between depths of 3,000 and 4,000 ft. which has a tendency to flocculate the mud. Anhydrite is encountered in stringers and in some areas substantial amounts may be found in the Glen Rose anhydrite and in the Buckner formations, where it is a particularly bad flocculating agent. Within comparatively short distances the Buckner formation may be either anhydrite, sand or lime, depending upon the location of the area.

During the early stages of drilling in South Arkansas there was trouble in drilling through a gravel bed containing large boulders at the base of the Tokio formation. These hard, heavy boulders would frequently roll against the drill pipe and dent it severely and entail a hazard of lodging so as to stick the pipe. In fact, until the nature of such damage was definitely identified it was often mistaken for the effect of faulty metal and complaints were made to drill-pipe manufacturers which were eventually found to be unwarranted. Now it is common practice to set an intermediate string of casing through these Tokio sections as a safeguard.



Mud pumps located close to boilers for rig of James C. Mayfield in the Midway field. Where terrain permits, Mayfield favors placing boilers on the "V" side of the derrick

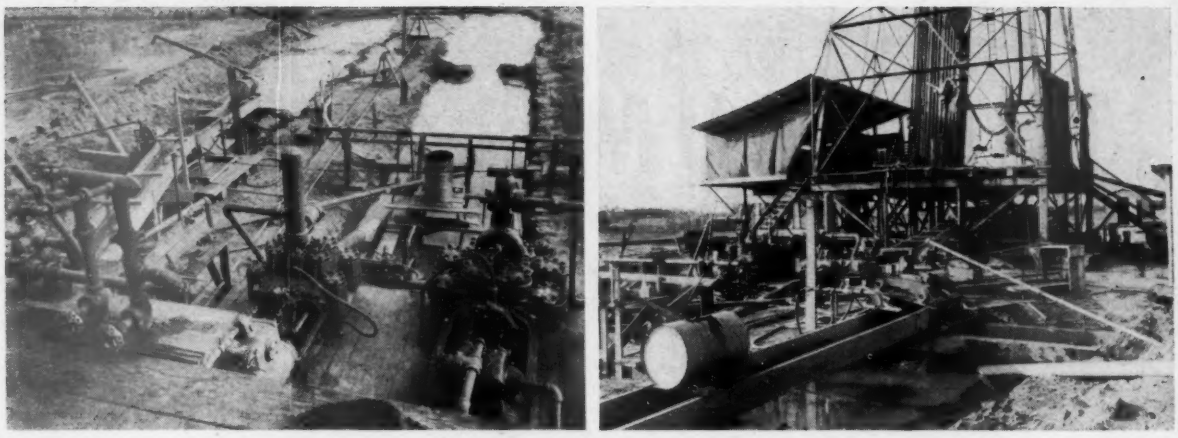
Several procedures have been adopted by James C. Mayfield as a result of years of experience as a drilling superintendent, before recently going in the business for himself as a drilling contractor. The most conspicuous of these is his practice of placing the boilers on the same side of the derrick as the "V" instead of behind the engine operating the draw works. In this unique plan, the boilers are located at a sufficient distance for safety and to allow ample space for the pipe rack. With the boilers in this position they are constantly within sight of the driller who can observe any inattention of the fireman which may result in costly and dangerous trouble.

James C. Mayfield, drilling contractor

Mud pits are laid out in such a manner that the mud pumps may be located as close to the boiler as practicable instead of at the side of and close to the derrick. The purpose of this is to operate with short steam lines which are regarded as more desirable than short mud lines.

When the terrain does not permit placing the boilers on the "V" side of the derrick, boilers are located in the customary manner, behind the draw works, and mud pumps are placed near the boilers.

Two factors are credited by Mayfield with effecting savings in time



Mud pumps and pits at well drilled by McAlester Fuel Co. in Dorcheat-Macedonia pool

amounting to a total of 8 days in the drilling of a 9,000-ft. hole. One of these is his practice of giving specia' attention to spudding-in and drilling the first 30 ft. which he supervises personally at each of his wells. For he has found that a deflection too slight to be detected by an instrument may result in unnecessary consumption of time in handling slips in the course of drilling the well. Such loss of time may total as much as 5 days on a typical well of the area. Straightness is insured for drilling the first 30 ft. by unusual care in leveling of the crown block and rotary table and in centering the kelly, without the kelly joint, over the center of hole.

A saving of 3 days has been estimated to result from the use of a "mouse hole" close to the rotary table for "rat-hole makeup" which has been widely used by drilling organizations in recent years.

Throughout the drilling of a well Mayfield has reamers on top of the drill collar to prevent having drill pipe catch in a key seat while coming out of the hole. Other advantages are believed to result from this practice. In the difference of opinion regarding key seating when it is said to be often mistaken for bridging, continued successful use of this procedure is believed to justify it.

In line with his policy of operating so that "most of the fishing may be done on top of the ground," Mayfield has drill pipe thoroughly inspected. Satisfactory results have been obtained with electric surveying of pipe by the method applied by Deep Well Pipe Survey, Inc., which has been effective in detecting defects. Survey data indicate whether pipe is: Grade 1, 85 per cent or better, equal to new pipe, good for drilling to depths of 9,000-10,000 ft.; Grade 2, 65-85 per cent, for 6,500 ft.; Grade 3, 45-65 per cent, 3,000 ft. In deep drilling, Grade 2 may be used inside of casing.

Drilling at slow rates of rotation is favored by Mayfield.

In his operations, he consistently uses low-water-loss mud which is treated daily. By treating all the way to the bottom advantages have been found in having a hole which is in beter shape to cement.

In South Arkansas there is a divergence of practices in regard to mud. Although extensive use has been made of native muds, especially a the beginning of drilling, it is reported that there is a trend toward increasing use of purchased materials to obtain low-water-loss mud. As would be expected much attention is given to chemical treatment of mud. Though it is not a general policy in the area some companies buy all of the mud used by contractors drilling for them. Many operators specify mud characteristics but not the brand to be used by the contractor. In the area muds of 9.5 to 9.7 lb. are widely used though heavier muds are preferred by some.

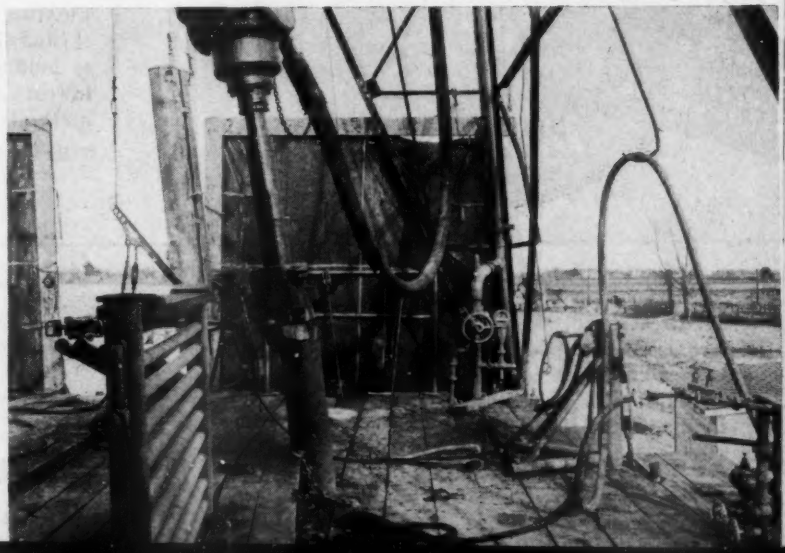
Much trouble, formerly attributed falsely to key-seating, is said to have been eliminated by low-water-loss mud with a thin filter cake since there is less chance of sticking the tools. It is also claimed that with it better results have been obtained in getting side-wall samples. With low-water-loss mud conditions are reported to be more favorable for cementing.

Due to the great depth of the wells and the long time that the heavy weight of the mud is on the Cotton Valley sand lenses while drilling to the Smackover lime during subsequent testing, a period, sometimes as much as 48 hours, is required to rid the sand of fresh water entering the Cotton Valley sands during these operations.

As in other areas, there is an increasing recognition in South Arkansas of the importance of good mud for safeguarding drill pipe. Because of the difficulties in getting new pipe, strings of drill pipe, which would have been junked after drilling 10 wells, are required to drill 15 or 16 wells before discarding.

In the development of each field in the area it is reported that approximately 15 per cent of the wells are calipered and temperature surveyed to locate the height of the cement. From these data future procedures for cementing are determined.

Portion of derrick floor of McAlester Fuel Co. rig in Dorcheat-Macedonia pool



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A Study of Corrosion in Gas and Condensate Wells in Katy Field, Texas

*by F. W. Jessen**

Corrosion trouble in the cycling of distillate fields has become sufficiently serious after the first few years of this young branch of the industry to call for scientific investigations to determine the most practicable means for combating the deterioration of equipment. Studies have been made of the relation of corrosion to the rate of flow of gas and the rate of absorption of carbon dioxide.

SEVERE corrosion of equipment in wells producing gas or hydrocarbon condensate has focused attention once again on the problem existing potentially everywhere that metals are exposed in process industries. Certain well-known fundamental chemical reactions, based on the electrochemical theory of corrosion, are generally accepted as explaining satisfactorily the mechanics by which metals pass into solution—corrode. Since under any given set of conditions certain variables are present, the corrosion encountered must be explained by accounting individually for each of such variables or collectively by grouping two or more of the factors. It is the purpose of this investigation (1) to determine, with the limited data obtainable, the possible cause of the corrosion noted in high-pressure gas and condensate wells; (2) to point out a probable mechanism whereby this corrosion takes place, and (3) to suggest factors to be studied in a laboratory investigation of the problem designed to ascertain the mode of attack on the metal by the corrosive media. Certainly no judicious choice of corrosion-resisting materials (metal alloys, for example) or proper treatment with chemicals to decrease the corrosivity, may be adopted without some knowledge of the basic cause of corrosion.

*Humble Oil & Refining Co. A paper delivered before the annual meeting of the National Association of Corrosion Engineers, Houston, April 10-12.

Previous Investigation

Apparently little cognizance has been given to the possibility of corrosive action on metals in gas or gas-distillate wells as evidenced by the dearth of previous information on the subject. Furthermore, the criteria for establishing whether or not corrosive action occurred may have easily been overlooked; however, recent failures of well equipment have aroused the intense interest of several investigators and has shown the imperative need for a critical examination of conditions under which corrosion of the metal developed and progressed before any measures could be instituted to inhibit the deleterious action.

The recent work of Bacon and Brown[1] in reporting the corrosion experienced in wells at the Opelika field in Henderson County, Texas, seemingly showed little correlation between the many factors considered. Undoubtedly numerous cases of a like nature have occurred elsewhere. Perhaps no ready, plausible explanation of the corrosion phenomena presented itself, or lack of time prevented further study.

Results of Present Investigation

The compilation of data obtained during the last 3 months at the Katy field in Harris and Waller counties has been made available for this study and is presented in Table 1. This data was accumulated over a period of several months, though not until January 1944 was an attempt made to obtain data in a fixed, routine manner. Meager information concerning many of the factors which may contribute to the over-all effect of corrosion is available in most instances. However, in two cases, namely wells K.F.G.U. 9 and K.F.G.U. 19, there seem to be a sufficient number of samples to justify some postulation on the mechanism of corrosion.

The following factors appear to be of prime importance, though it is recognized that others may be of secondary value: (1) Daily average production rate of gas, hydrocarbon distillate, and water; (2) reservoir temperature and pressure; (3) well-head

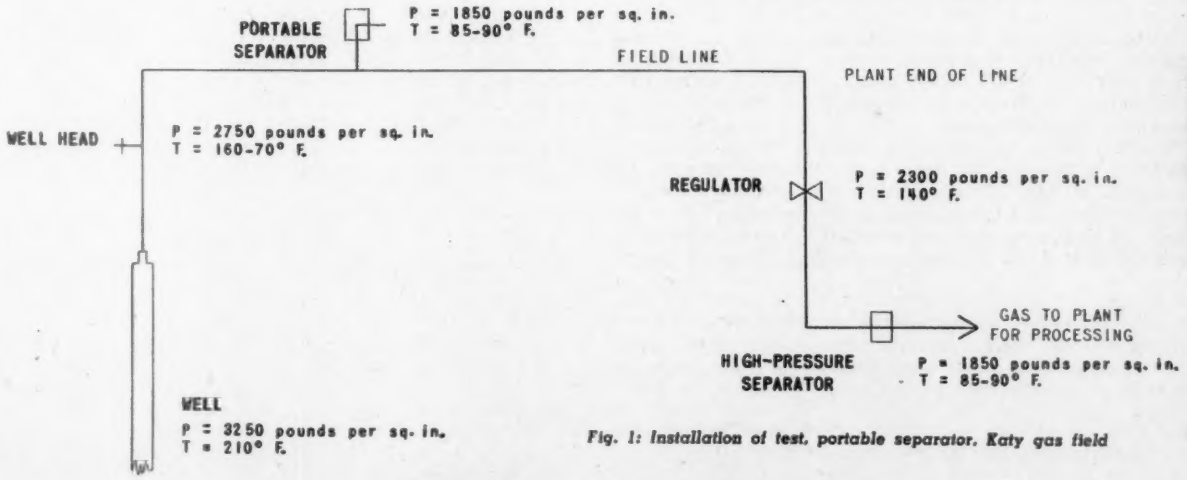

PORTABLE SEPARATOR
P = 1850 pounds per sq. in.
T = 85-90° F.
FIELD LINE
PLANT END OF LINE
WELL HEAD
P = 2750 pounds per sq. in.
T = 160-70° F.
REGULATOR
P = 2300 pounds per sq. in.
T = 140° F.
GAS TO PLANT FOR PROCESSING
HIGH-PRESSURE SEPARATOR
P = 1850 pounds per sq. in.
T = 85-90° F.
WELL
P = 3250 pounds per sq. in.
T = 210° F.

Fig. 1: Installation of test, portable separator, Katy gas field

TABLE 1—SUMMARY OF DATA FROM WELLS, KATY FIELD, TEXAS, JULY 1943-APRIL 1944

Date	Well No. or source of sample	Prod. (M.c.f.)	Portable field separator: Temp. (°F.)	Portable field separator: Pressure, lb./sq. in.	Total fluid produced gal./day	Water-gas ratio determined by portable field separator	Analysis of condensed water (p.p.m.): pH	Carbon dioxide	Bicarbonate	Chloride	Iron	Remarks
7-21-43	High-pressure separator	.....	...	....	6,000	.....	6.0	...	299	None	247	Oxygen none
8-11-43	High-pressure separator	.....	..	....	6,000	.....	5.8	97	275	None	197	
12-22-43	High-pressure separator	.....	...	....	10,000	.....	6.2	27	372	None	600	
8- 4-43	K.F.G.U. 4	18,700	89	1,800	.....	.....	4.9	19	...	...	127	Downstream from choke
8- 4-43	K.F.G.U. 4	.....	105	1,800	.....	.....	5.2	13	...	...	92	Upstream from choke
2- 1-44	K.F.G.U. 4	21,000	90	1,850	.....	.....	6.3	194	97	16	142	
8-11-43	K.F.G.U. 19	27,500	88	1,800	.....	.....	5.2	77	...	50	251	Upstream from choke
8-11-43	K.F.G.U. 19	.....	88	1,800	.....	.....	5.2	90	..	45	178	Downstream from choke
1-29-44	K.F.G.U. 19	9,000	..	....	.....	.....	6.0	107	...	25	33	
2-24-44	K.F.G.U. 19	16,200	...	....	.....	2 cc./54 cu. ft.	6.4	None	49	174	540	Casing and tubing open
3- 3-44	K.F.G.U. 19	15,400	...	....	.....	2 cc./100 cu. ft.	6.5	None	50	16	227	Casing and tubing open
3-13-44	K.F.G.U. 19	15,600	92	1,850	.....	3 cc./120 cu. ft.	5.8	None	134	None	192	Tubing flowing
3-17-44	K.F.G.U. 19	15,700	88	1,850	.....	5 cc./17 cu. ft.	5.5	None	49	22	156	
3-24-44	K.F.G.U. 19	20,800	82	1,850	.....	14 cc./14 cu. ft.	5.5	151	183	52	21	
8-24-43	K.F.G.U. 16	25,400	86	1,800	.....	.....	5.5	...	...	30	200	Upstream from choke
2- 2-44	K.F.G.U. 16	21,000	85	1,850	.....	.....	6.4	14	110	28	185	
9-13-43	K.F.G.U. 9	.....	...	....	.....	.....	6.1	None	...	None	64	Downstream from choke
1-31-44	K.F.G.U. 9	22,200	90	1,850	.....	15 cc./15 cu. ft.	6.0	84	...	20	220	
2-24-44	K.F.G.U. 9	12,800	90	1,850	.....	11.0 cc./19.5 cu. ft.	6.2	None	122	194	199	Csg. flow.—tubing S.I.
3- 2-44	K.F.G.U. 9	15,900	..	....	.....	11.0 cc./19.0 cu. ft.	6.4	None	110	26	213	Tubing shut in.
3- 9-44	K.F.G.U. 9	20,100	...	....	.....	11/22.5 cu. ft.	6.5	85	122	12	256	
3-16-44	K.F.G.U. 9	21,400	88	1,850	.....	7 cc./25 cu. ft.	6.3	None	71	None	305	Tubing flowing
3-26-44	K.F.G.U. 9	26,200	80	1,850	.....	7 cc./23 cu. ft.	5.0	75	134	42	107	
1-31-44	K.F.G.U. 7	23,700	90	1,850	.....	19 cc./11 cu. ft.	5.8	163	...	20	69	
1-31-44	K.F.G.U. 8	18,900	90	1,850	.....	18 cc./10 cu. ft.	6.0	21	...	15	160	
1-29-44	K.F.G.U. 3	....	...	....	.....	.....	6.0	65	...	128	0.7	
2- 1-44	K.F.G.U. 5	20,000	90	1,850	.....	.....	6.4	101	122	38	263	
1-31-44	K.F.G.U. 22	30,000	92	1,850	.....	.....	...	146	305	66	121	
2- 2-44	K.F.G.U. 18	15,000	90	1,850	.....	.....	5.3	11	110	82	71	
2- 3-44	K.F.G.U. 11	12,000	90	1,850	.....	.....	6.5	None	97	32	291	
2- 4-44	K.F.G.U. 12	17,000	90	1,850	.....	.....	6.6	None	366	20	263	
2- 4-44	K.F.G.U. 13	17,000	90	1,850	.....	.....	.	None	97	34	270	
2- 4-44	K.F.G.U. 3-2	20,000	90	1,850	.....	.....	6.4	87	220	378	85	
2- 4-44	K.F.G.U. 16-2	10,000	90	1,850	.....	.....	6.5	None	73	58	341	

* Shut-in well-head temperature—depends on length of time shut in. Shut-in well-head pressure—2,750 lb. per sq. in. Reservoir temperature—210° F. Reservoir pressure—3,250 lb. per sq. in. Flowing well-head temperature—160°-70° F. Flowing well-head pressure—2,500 lb. per sq. in.

flowing temperature and pressure; (4) well-head shut-in temperature and pressure; (5) composition of gas, and (6) composition of produced or condensed water. Other factors which may possibly contribute to the corrosion are variations in the metal, such as slag inclusion, stress and chemical impurities; and certain electrical effects, as streaming potentials and stray current electrolysis. The present discussion, however, is limited to the former variables though a comprehensive study of all factors may be necessary before complete solution of the problem is obtained.

Table 1 shows the well from which samples were obtained, date, production rate of gas, operating temperature, pressure and temperature of the portable field separator, and the analysis of the water condensed while the well was producing at the rate indicated. In addition, the column "water-gas ratio" gives the amount of water condensed when the indicated volume of gas was passed through an experimental portable separator operated at the temperature and pressure shown.

The portable separator was placed so as to secure a sample from the flow line from the well immediately downstream from the well head, the pressure being maintained at the pressure prevailing at the plant; that is, 1,850 lb. per sq. in. Likewise, the temperature was kept fairly constant at 85° to 90° F. Fig. 1 shows the relative positions of the separator, well-head equipment, field lines, and plant. Gas was withdrawn from the field line near the well head, and sampling was done at the side of the line. Although it was recognized that this manner of sampling would not yield entirely representative volumes of gas and water, it was thought that over a suficiently long period numerous samples removed in identical manner would indicate relative changes in water volumes, chemical composition of the water, pH, etc.

From a laboratory analysis of the water, which contains the corrosion products as well as the elements of the corroding medium itself, the flow rate of the wells, and an estimation of the ratio of hydrocarbon condensate to water production, it appeared possible to explain some of the findings that are tabulated in Table 1.

If it is postulated that the corrosion is due to the action of carbon dioxide under pressure in the presence of water, which action was found by Miller and Heneska[9] to dissolve iron and produce ferrous bicarbonate, though rate of solution was decreased as the bicarbonate concentration increased, it follows that (1) the rate of deposition of water, either in the form of droplets or continuous film, influences the corrosion; (2) the per cent carbon dioxide present in the gas enhances the rate of absorption of carbon dioxide by condensed water; (3) the linear velocity of gas controls the absorption rate or replacement of carbon dioxide resulting from exhaustion of the same in the liquid phase through the reaction to form ferrous bicarbonate; (4) the reaction rate should be decreased as corrosion products accumulate, provided gas velocity allows continuity of liquid film; and (5) the higher the ratio of hydrocarbon condensate to water condensed, the lower should be the corrosive action; that is, in the complete absence of water, the rate of corrosion is assumed to be extremely low.

The question as to what factor or factors actually control the corrosion

TABLE 2—RATE FACTORS INFLUENCING CORROSION OF STEEL BY DISSOLVED CO_2

I. Rate of flow. Related to:
1. Well-head temperature and pressure
2. Water produced from well bore
3. Water condensed, thickness of film
4. Chemical composition of water condensed
5. Hydrocarbon condensate

II. Rate of absorption of CO_2. Related to:
1. pH, diss. CO_2, HCO_3, of condensed water
2. Size of drop considered or thickness of water film
3. Iron content of condensed water
4. Hydrocarbon liquid film
5. Temperature
6. Pressure
7. Rate of flow
8. Composition of gas

$$CO_2\,(\text{gas}) \overset{H_2O}{\rightleftarrows} CO_2\,(\text{dissolved}) \downarrow\uparrow H_2CO_3 \downarrow\uparrow H^+ + HCO_3^- \downarrow\uparrow H^+ + CO_3^{--}$$

III. Rates of reaction involving the metal. Related to:
1. Absorption of CO_2
2. Amount of water wetted surface, i.e., ratio of liquid hydrocarbon : water
3. Removal of reaction products, i.e., products of corrosion
4. Secondary reactions
5. Pressure and temperature

$$2H_2CO_3 + Fe \rightleftarrows Fe(HCO_3)_2 + H_2^\circ \quad (\text{metal})$$

Actually

$$2H^+ + Fe^\circ \rightleftarrows Fe^{++} + H_2^\circ \quad (\text{metal})$$

Possibility of secondary reaction:

$$Fe(HCO_3)_2 + 2HOH \rightleftarrows Fe(OH)_2 + 2H_2CO_3 \downarrow\uparrow H^+ + HCO_3^- \downarrow\uparrow H^+ + CO_3^{--}$$

rate of the iron may be summarized in a consideration of various interdependent rates, which are given in Table 2. The dependency of variables related to each of the individual rates shown is not confined arbitrarily to that particular process, but may be influenced by other reactions. For example, the rate of reaction of carbonic acid with iron will be dependent on the amount of carbon dioxide absorbed by the water film as well as by the removal of reaction products. However, under certain fixed or controlled conditions of temperature, pressure, and composition of the gas the over-all corrosive action resulting in the solution of iron may be evaluated in terms of only three variables: (1) The rate of flow, (2) amount of water produced or condensed, and (3) the amount of hydrocarbon liquid condensate present.

The absorption of carbon dioxide by water droplets and thin films has been studied by numerous investigators[2,4,5,9,13,15]. The effects of pressure and temperature on the solubility of carbon dioxide in water have been investigated by Steenhoff and Moller,[19] Wiebe and coworkers,[17,18] and Katz,[7] while Shen-Wu Wan and Dodge[14] reported results on solubility of carbon dioxide in benzene at elevated pressure.

The hydrogen ion concentration, the equivalent amounts of bicarbonate ion formed, and the dissolved carbon dioxide which exists when carbon dioxide is dissolved in water were found by several investigators[2,10,12] to be related to pressure, the hydrogen ion concentration being calculable from a consideration of the equilibrium constant and the pressure.

An examination of the data of Table 1, plotted in Fig. 2, for well K.F.G.U. 9 which, incidentally, is the only system from which representative data extending over a period of 2 months is available, shows some rather interesting points.

Before considering the curves of Fig. 2 it seems appropriate to study the relative amounts of water present in the gas produced from the wells at Katy. The results of a study of the methane-water system by Olds, Sage, and Lacey[11] indicates that the moisture content of saturated gas of approximately the same composition as that at Katy at a reservoir pressure of 3,250 lb. per sq. in. and temperature at 210° F. is 40 gal. per million cubic feet. At a pressure of 2,500 lb. per sq. in. and a temperature of 170° F. the saturation is 20 gal. per million cubic feet; whereas at 1,850 lb. per sq. in. and a temperature of 85° to 90° F., a decrease in saturation to 3 gal. per million cubic feet is reached. Obviously, if it is assumed that saturation of the gas with water does occur at reservoir conditions, 20 gal. of free water (in liquid form) is present under well-head conditions, while slightly less than 40 gal. is condensed under conditions prevailing at the high-pressure separator at the plant and in the experimental portable field separator. Actual determinations of the total amount of water produced in the high-pressure separator at the plant yielded values of 28 to 30 gal. per million cubic feet. This water constitutes the major factor in the corrosion encountered.

The total quantity of hydrocarbon liquid condensed was determined to be 40 gal. per gallon of condensed water. Of this amount of condensate, a rough estimate of the relative amount present as liquid at well-head conditions of temperature and pressure yields a value of 20 gal. per gallon of water. Thus, on an average, water constitutes approximately 5 per cent of the material present in the flowing gas stream at well-head pressure and temperature. The volumes of water condensed in individual trials with the portable field separator at the various wells vary greatly from a minimum of 5 gal. per million cubic feet per day to a maximum of 500 gal. per million cubic feet per day.

In Fig. 2 is plotted the data from two wells, K.F.G.U. 9 and K.F.G.U. 19, showing the total iron concentration and the chloride content in parts per million in the produced water versus the rate of flow of gas in million cubic feet per day. The iron content of the water from K.F.G.U. 9 increases with rate of flow of gas up to about 21 million cubic feet per day and then decreases rapidly with increasing rates of flow. A much lower value of iron is determined at the

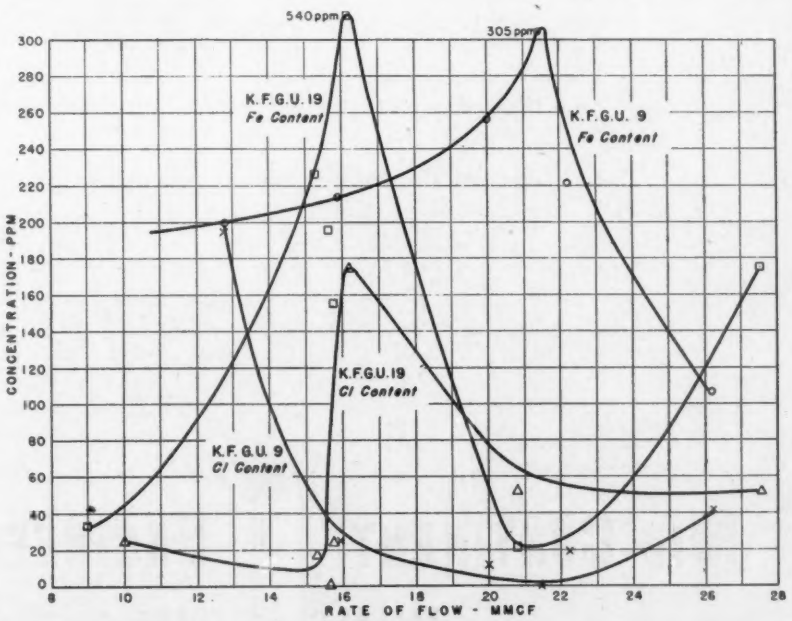
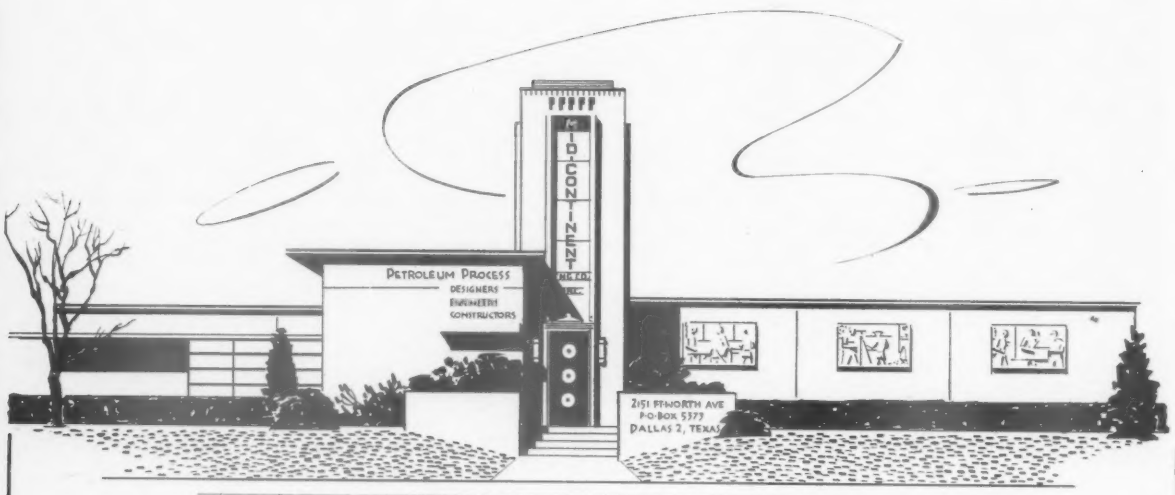


Fig. 2: Variation of iron and chloride content of condensed water with rate of flow



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rate of 26.2 million cubic feet per day than any of the concentrations found at lesser rates of flow. The net result of lower iron concentrations is most likely due to a combination of various diffusion rates and chemical reaction rates and is in agreement with the findings of Yushkevich, Zhavorankov, and Zel'venskii,[19] that the absorption coefficient of carbon dioxide in water was directly proportional to the intensity of wetting of the surface, yet the rate of increase of this absorption coefficient decreased with lessened wetting. The chloride concentration varies indirectly with the iron content of the water, reaching a minimum at the point of maximum iron content and rising slightly as the iron concentration decreases. Somewhat different conditions apparently exist in K.F.G.U. 19. The range of variation in flow rate is comparable to that in K.F.G.U. 9. However, discounting the rather nondeterminate factors, it may be seen that a rather sharp reduction in the iron content of the water occurs with increased rate of flow beyond 16 million cubic feet per day and increases again as a rate of 27.5 million cubic feet per day is reached.

pH Relationships

In order to determine whether or not any definite relationship existed between the dissolved carbon dioxide, pH, and bicarbonate ion, these values were plotted against the rate of flow. The results are presented in the curves of Figs. 3(a) and 3(b). As the rate of flow of gas increases, the pH increases slightly until a maximum is reached corresponding to the same rate of flow at which a maximum in the iron concentration of the water occurs as shown in Fig. 2. A rapid decrease in pH then occurs, accompanied by a sharp rise in the dissolved carbon-dioxide content, which also subsequently decreases somewhat with increasing flow. There is less noticeable change in the bicarbonate ion concentration.

To account for the correlation between the decrease in iron concentration with decreased pH, occasioned by greater amounts of dissolved carbon dioxide, requires that the rate of reaction of hydrogen ion with metallic iron is less than the rate of absorption of carbon dioxide by water or that the increased rate of flow of gas removes the water film on the metal before reaction between the hydrogen ion (of the carbonic acid) and the iron has proceeded very far. More or less, the same general agreement, involving the three rates previously outlined (refer to Table 2) is obtained at lower rates of flow of gas. In the case of the increased solution of iron, with increasing pH and lesser amounts of dissolved carbon dioxide, the rate apparently is such that sufficient time elapses in the interval between the initial absorption of carbon dioxide by the water film or droplet to allow the reaction between the hydrogen ion and iron to proceed nearly to completion while the drop or film is in contact with the metal. The copresence of a nonaqueous film would also undoubtedly influence the rate of absorption of carbon dioxide, though Klyucharev[5] found that 0.1 mm. thick film of crude petroleum or machine oil on water had practically no effect on the rate of solution of carbon dioxide in water.

The preceding discussion leads to a plausible explanation of the mechanism of reaction for the corrosion encountered and one which lends itself to laboratory investigation. It is therefore tentatively proposed that any laboratory study which might be initiated include a consideration at the appropriate temperature and pressure of the variables discussed: namely, (1) the rate of absorption of carbon dioxide from the gas to the liquid film at various rates of flow; (2) the velocity of reaction of water saturated with carbon dioxide and steel; (3) the effect of varying the ratio of condensed water to hydrocarbon condensate, and (4) the effect of varied rates of flow on fluid-film thickness, rate of movement of fluid films, or droplet behavior at high rates of flow.

Summary

An examination of data, considered to be representative, available from a well in the Katy field, Waller

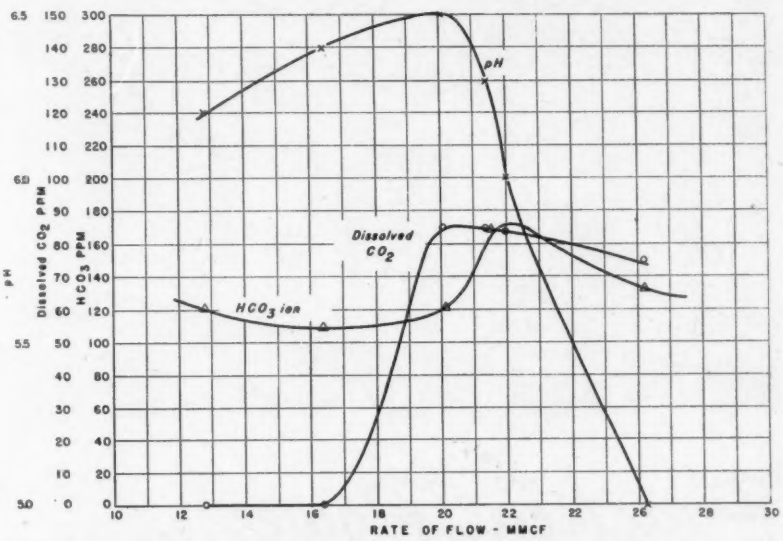

Fig. 3 (a): Variation in pH, dissolved CO_2 and HCO_3 in concentration in condensed water from Katy gas field Unit 9, from January 31 to March 26, 1944

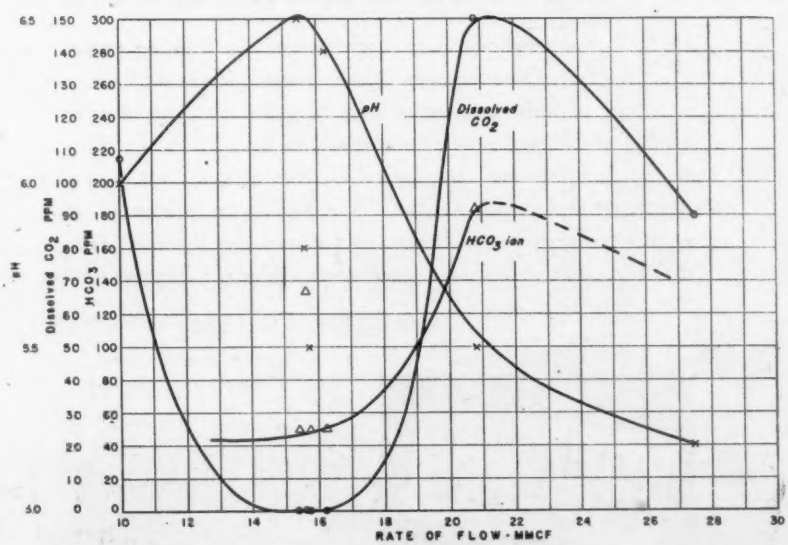

Fig. 3 (b): Variation in pH, dissolved CO_2 and HCO_3 in concentration in condensed water from Katy gas field Unit 19, from January 25 to March 24, 1944

County, Texas, indicates that the corrosion of steel may be correlated with the rate of flow of gas, which in turn is believed to contribute largely to the rate of absorption of carbon dioxide. Evidence is presented to show that the rate of reaction of dissolved carbon dioxide with steel at the pressures and temperatures encountered in the operation of gas and condensate wells seems dependent on the rate of absorption of carbon dioxide and the length of time the fluid film is in contact with the metal. The continuity of a fluid film is questionable at higher rates of flow. It is believed that the ratio of condensed water to hydrocarbon condensate is also of considerable importance in the corrosion of steel by high-pressure gas.

It is felt that invaluable information may be gained by a laboratory study of the problem of corrosion occurring in high-pressure gas and condensate wells. An essential part of any program of laboratory research of the problem should be a consideration of the factors of rate of flow of gas, absorption of carbon dioxide by fluid films, rate of reaction of dissolved carbon dioxide on steel at prevailing temperatures and pressures, fluid-film behavior at high flow rates, and the effect of water-hydrocarbon condensate ratio.

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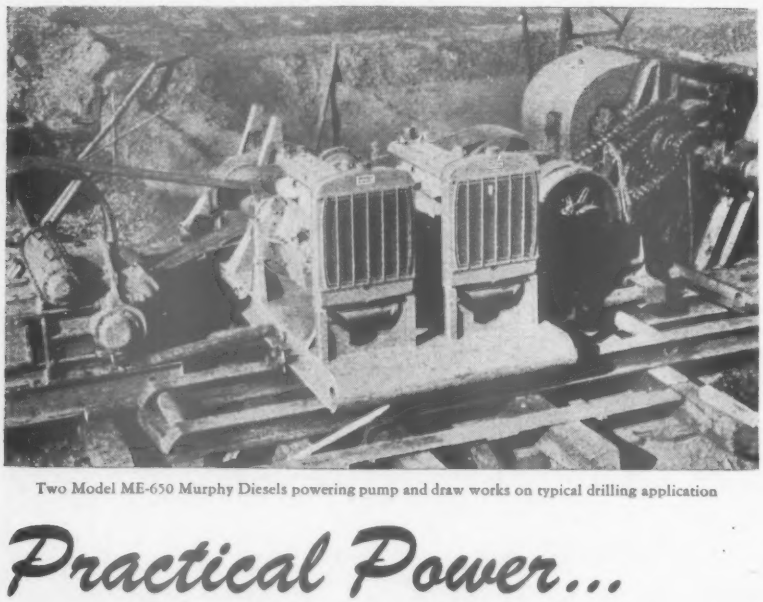
BOOKS

"PEACE, PLENTY AND PETROLEUM"—By Benjamin T. Brooks. ($2.50—Jaques Cattell Press, Lancaster, Pa.)

The author accepts the probability that the United States is no longer selfsufficient in petroleum reserves and that this is a situation for serious concern but not alarm. After a concise factual and interpretative summary of the domestic history of the industry and its growth, he discusses petroleum from the standpoint of the engineer and the chemist as a source of energy and of a raw material for chemical products. This is followed by a brief but comprehensive discussion of petroleum substitutes.

The major part of the book, and that which will arouse the most interest and controversy, deals with the international aspects of petroleum. After establishing the vital part that oil plays in our peacetime economy and its absolute essentiality to victory in modern mechanized war, thereby showing why national governments take so much interest in the problem, he discusses the international aspects, giving a condensed history of the international rivalries and machinations during the past 20-30 years.

The relatively small geographic areas where oil is found, their strategic international location, the activities of various governments, the problems involved in exploiting such a natural resource are discussed in what is an unbiased and clear manner, provided the reader agrees with the author's basic premise about insufficiency of domestic resources.



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The Drowning and Revival Of Gas Wells—Part 2

by S. T. Yuster and K. J. Sonney†*

In part 1 of this article which appeared in the April 20 issue, the authors discussed the effect of water and other fluids upon the flow of gas in a reservoir. Part 2 covers laboratory studies pertaining to methods for drowning of gas wells under controlled conditions. A third article to be published in an early issue will describe practical field experiments which have been made in revival of drowned wells.

IN some cases it may be necessary to drown a gas well, but it is desirable to do so under controlled conditions which will enable the operator to bring it back to normal production at will. This is advantageous in bringing a wild well under control or when special treatment is necessary on an already completed well. One of the first thoughts for doing this would naturally be the use of a mixture of water and one of the liquids (such as acetone) mentioned in Part 1 of this article. Although such a mixture is infinitely better than water alone, there are still better mixtures available. The vapor pressure of these mixtures is limited by the vapor pressure of the liquid which is added to the water. Since there is usually no water in the producing sand of a well which it is desired to "kill," the drowning liquid need not be miscible with water in all proportions. About the only condition necessary is that it have a higher vapor pressure. Natural gasoline is such a liquid which is low in price.

The principle of killing a well is dependent upon applying a column of liquid in the well which exerts a pressure that is at least equal to the formation pressure. Natural gasoline might be used for the purpose under certain limited conditions where the formation pressure is relatively low. If the bottom-hole pressure in the well is greater than the head of gasoline in it, it will not be possible to kill the well with this liquid. If a volatile liquid having a density equal to, or greater than, that of water could be used, it would be highly advantageous. Examples of liquids of this type are the chlorinated hydrocarbons such as carbon tetrachloride (sp. gr. 1.595), or mixtures of hydrocarbons such as natural gasoline and carbon tetrachloride in the proper proportions. Such mixtures can be adjusted to any density within the range of the components.

Although the mixture alone can be used for killing a well, it may be too expensive to fill the well bore with it. If some sort of packer arrangement with very little tubing to the surface could be set in the well, the head of liquid could be obtained without excessive quantities of liquid being necessary. It is possible, however, to use a relatively small quantity of the volatile, water-immiscible liquid along with a large quantity of water. If the volatile liquid mixture is adjusted to a density greater than that of water, it may be poured or lubricated into the well in such quantities as to wet the sand and extend up into the well for some convenient distance. If water is poured into the well after it, the water, being the lighter of the two liquids, will float on the volatile liquid. Sufficient water is then added to kill the well. There will be some tendency for the volatile liquid to penetrate the formation and if the proper precautions are not taken, the water will finally enter the sand, a condition which must be avoided. In order to eliminate this danger, more volatile treating liquid might be poured on top of the water and being heavier than it, will go to the bottom of the well and prevent the water-hydrocarbon liquid interface touching the sand. Rate of adding this liquid should be determined by the rate at which the well takes liquid during the shut-

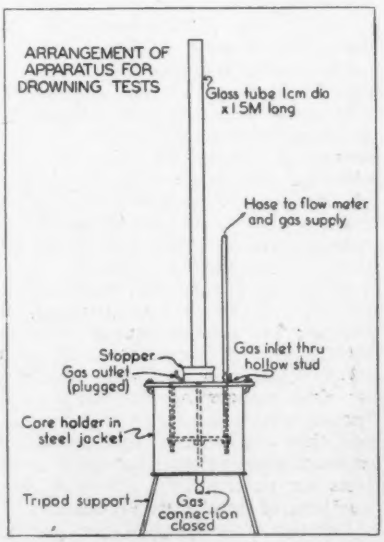
ARRANGEMENT OF APPARATUS FOR DROWNING TESTS
Glass tube 1cm dia x 1.5M long
Hose to flow meter and gas supply
Stopper
Gas outlet (plugged)
Gas inlet thru hollow stud
Core holder in steel jacket
Tripod support
Gas connection closed

Fig. 1

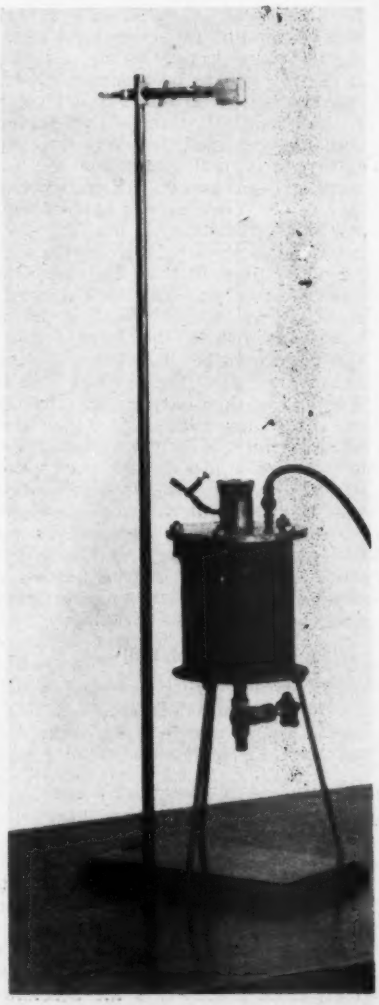

Fig. 2

*Associate professor of petroleum and natural-gas engineering, School of Mineral Industries, Pennsylvania State College.
†United Natural Gas Co.

down and the rate at which the added hydrocarbon liquid falls through the water column. After the conditioning of the well has been completed, the water can be removed and the volatile liquid will be evaporated by the gas in the formation.

Apparatus and Experimental Method

The apparatus shown schematically in Fig. 1 and photographically in Fig. 2 was used to test the possibilities of the theory just discussed. A core held in the usual coreholder was placed in the pressure pot which rested on a tripod. A long glass tube was inserted into a stopper and placed into the outlet end of the coreholder. This acted as well tubing. Dry compressed air was used as the gas and injected into the pressure pot so that it flowed radially through the core and out the well tubing. Liquids were poured into the glass tubing until the flow of gas ceased, and as the level decreased due to penetration in the sand, sufficient liquid was added to maintain a safe head in order to prevent blowouts. After the laboratory "well" had been dead for some time, the head was lowered by removing some of the liquid, thereby permitting gas flow from the well to be resumed. Observations were then made to determine if the original rate of production could be regained. In every case the return to normal production was extremely rapid and no difficulty whatsoever was encountered in removing all of the treating liquid. The well could be kept killed for any desired length of time. In the experiments in which water was used with hydrocarbon liquids, the treating liquid was poured into the tube until a sufficient quantity had been injected to keep the sand face covered with it. Water was then poured in until all gas flow had ceased. As the fluid level declined, a carbon tetrachloride-natural gasoline mixture was added in sufficient quantities to maintain the liquid level up to the point where no gas flowed from the sand. It was not possible to carry out any extended experiments on this particular phase of the work due to the small size of equipment.

Rate of Fall

Calculations of the rate at which the treating liquid will fall through the water column may be attempted by means of Stokes law as follows:

$$(1) \qquad V = \frac{2\ g\ a^2\ (d_1 - d_2)}{9\ Z}$$

where V is the velocity of fall in centimeters per second of sphere having a radius of "a" centimeters and a density of d_1 (gms. per cm.^{3}) in a fluid of density d_2 and having a viscosity of Z poises. g is the acceleration of gravity (980.6).

For the particular conditions used in this work $d_1 = 1.135$, $d_2 = 1.0$ and $Z = .01$. Then $V = .155\ a^2$ in which V is now given as the velocity of fall in feet per second and "a" the radius in centimeters. A sphere of the treating liquid having a radius of 1 cm. will fall through the water column in the well at a rate of .155 ft. per second and having a radius of 2 cm. will fall four times as fast.

It can be seen that this rate may be too slow for deep wells or where the sand may take the treating fluid at a fairly rapid rate. Under such circumstances, it might be well to inject the treating fluid into the bottom of the well through macaroni tubing.

From the results of these experiments, it would seem that it should be possible under specialized conditions to kill a well by the methods just discussed. With extremely high pressures in a wild well, it is doubtful if these methods could be adapted.

Acknowledgments

The authors wish to thank J. G. Montgomery, vice president of United Natural Gas Co., and Dr. A. W. Gauger, Director of Mineral Industries Research, at Pennsylvania State College, for their suggestions and criticisms during this work. Acknowledgments are also due to the members of the Petroleum Production Research staff at Pennsylvania State College with whom this problem has been discussed on numerous occasions.

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Committee D-2 on Petroleum Products Holds Symposium on Sulfur Determination

AN informal symposium on sulfur determination and important actions on new and revised standards highlighted the Cincinnati meetings of Committee D-2 on petroleum products and lubricants. At the symposium March 3, four papers were presented, describing several new and improved methods now being studied for determining sulfur.

1. "Quartz Tube Method for Determination of Sulfur Content of Low Volatile Products," Louis Lykken, Shell Development Co.

2. "The Use of the Parr Photoelectric Turbidimeter," Julian Alexander, Catalytic Development Co.

3. "The Vertical Combination Tube Method," E. P. Rittershausen, Socony-Vacuum Oil Co., Inc.

4. "Further Refinements of the Lamp Sulfur Method," Louis Lykken.

Committee D-2 has just completed four new emergency methods and one emergency alternate provision which cover determinations for certain elements in lubricating oils, such as, chlorine (by bomb method); phosphorus, lead, copper and iron; other metals; and as an emergency alternate provision, a test for sulfur by the bomb method.

Studies continue very actively on the method of test for neutralization number by color-indicator titration (D 663), and by electrometric titration (D 664). Based on test data obtained by eight cooperating laboratories and further experience with these methods, they are being revised, including new titles to indicate that they cover tests for determining acid and base numbers of petroleum products.

Decision was reached for aniline point (D 611) to include in the test a procedure for determining the aniline point of high-solvency petroleum fractions using n-heptane as the diluent.

Among the standardized test methods in which revisions will be recommended are the test for consistency of lubricating greases and petrolatum (D 217), rust-preventing characteristics of steam-turbine oil (D 665), sulfur in petroleum oils (bomb method) and the test for gum content of gasoline (D 381).

The committee has reviewed various specifications and test methods and recommended to the society for adoption as standard four tentative standards:

1. Saponification Number by Color-Indicator Titration (D 94).

2. Knock Characteristics of Motor Fuels (D 357).

3. Conversion of Kinematic Viscosity to Furol Saybolt (D 666).

4. Test for Oil Content of Paraffin Wax (D 721).

The committee plans to recommend to the society in June the withdrawal of the tentative specifications for aviation gasolines (D 615-41 T) since they do not at present represent current practice for this type of gasoline.

The proposed method of test for potential gum in aviation gasoline, published in draft form as information in 1942, has been further revised and it is expected will again be published for the purpose of soliciting further comments and suggestions.

Officers of Committee D-2 are: Chairman, T. A. Boyd, Research Laboratories, General Motors Corp., Detroit, and secretary, R. P. Anderson, American Petroleum Institute, New York.

Oil-Well Pumping Practices—No. 34

Factors Affecting Design of Hydraulic Pumping Systems

by J. Zaba

The hydraulic pumping system to be used is largely dependent upon the ideas of the operator concerned as to the proper balance between present and future cost of investment and cost of maintenance and operation. In this, first consideration must be given to future demands upon the installation. Methods of determining these demands are discussed in this article.

ASSUME the case of a producing property to be put on the mechanical lift. Analysis of the existing conditions has been made and on basis of the results of this analysis it has been decided to employ the method of multiple hydraulic pumping. The next step is design of installation which would be most economical and efficient under existing operating conditions.

As in the case of a sucker-rod pumping installation, the ultimate design of the hydraulic pumping system to be used will depend on the ideas of the operator as to the proper balance between present and future cost of investment and cost of maintenance and operation. From data on reservoir, well and produced fluid characteristics, and in absence of such data from estimates, future demands of installation can be arrived at. Or, the existing conditions may be disregarded and conditions may be assumed of dead lift of fluid, consisting of water entirely, with no submergence pressure.[1]

The amount of fluid which has to be handled would be the starting point of the design of the installation. From the manufacturer's specifications, size and type of the pump can be selected with displacement corresponding to the expected production. Tubing already in the well may satisfactorily serve the purpose although the selected size of pump will of course have a bearing on the size of tubing. As far as power tubing is concerned this is usually selected in certain specified combinations with the corresponding size of production tubing. These combinations have been shown in chart (Fig. 1) in the preceding installment of the series. The size of the surface power lines will depend on the type of installation selected. In some installations, each of the pumped wells has its individual power line leading directly to the central power plant. In other cases a line of larger size conducts the power oil from the central plant through the lease with laterals of smaller size delivering power oil to the individual wells. Selection of one of these two alternatives will depend on shape and size of property, spacing of wells and ideas and preferences of the operator. In either case the size of the lines will be governed by the amount of fluid to be handled.

As previously stated (Installment 33) the required operating pressure, expressed in pounds per square inch, is usually taken as from 40 to 50 per cent of lift, expressed in feet. This figure applies to production units with 1:1 ratio of areas of the hydraulic engine piston and of the pump. In estimating the amount of power oil needed the displacement of the subsurface pump is sometimes considered as being 80 per cent of the surface triplex pump.[1] With the required pressure and the needed amount of power oil determined, the type of surface triplex pump or pumps needed can be selected from the available sizes.

Selection of type of prime mover will be governed by a large number of factors. These factors were already discussed in conjunction with consideration of selection of type of power for sucker-rod pumping installations (Installment 18). The amount of power required can be calculated from the formula:

$$HP = \frac{L \times P \times W}{33{,}000 \times 1{,}440 \times E}$$

where

HP = horsepower input needed
L = lift, in feet.
P = production, bbl. per day
W = weight of fluid, lb.
E = over-all efficiency, assumed usually as 0.6

Selection of the type of power-oil settling system completes the design of the installation. Here, more than in case of other component parts of the installation, the ideas and preferences of the operator will have important bearing. Tankage and dehydrating system, already available on the property, will of course be considered. The required capacity of the system will depend on amount of power oil used and size of pump together with extra power oil capacity considered as a safe reserve for contingencies.

Bottom-Hole Conditions Determination

Within the limits of accuracy of gages used and of manner of determining the friction losses and fluid density, certain data relating to bottom-hole conditions of a well can be accurately observed and calculated from the pressures recorded by the gages of the hydraulic pumping installation. The method, as outlined by C. J. Coberly, includes calculations of bottom-hole pressure, drawdown and productivity index.[2]

For static conditions, for equal densities of column of power oil and produced oil, for equal plunger areas and for no surface back pressure following simple equation can be written:

$$P_1 = P_2 - P_3 \qquad (1)$$

where

P_1 = operating pressure
P_2 = discharge column pressure
P_3 = submergence pressure

The equation states that, with the column pressures balancing themselves out, the operating pressure needed equals the pressure of the net lift. This equation can be also written:

$$P_3 = P_2 - P_1 \qquad (2)$$

In other words the bottom-hole pressure equals the pressure of the full column less the operating pressure. Thus, for this simple set of conditions the bottom-hole pressure can be determined from the setting of pump, average density of fluid and operating pressure. If the discharge fluid column contains appreciable amounts of free gas the average density would be difficult to estimate. To overcome this difficulty back pressure can be applied to the production tubing to hold the gas in solution.

Application of back pressure has a double effect on the operating pressure. First it acts directly on the hydraulic engine piston and second it acts on the subsurface pump piston. Therefore:

$$P_1 = P_2 - P_3 + 2P_4 \text{ or} \qquad (3)$$

$$P_3 = P_2 + 2P_4 - P_1 \qquad (4)$$

where

P_4 = back pressure

and other symbols are as in preceding formulas.

For pump-piston to engine-piston ratio other than 1:1 correction factor must be applied:

$$\frac{a_1}{a_2} P_1 = P_2 - P_3 + P_4 + P_4 \frac{a_1}{a_2} \text{ or} \quad (5)$$

$$P_3 = P_2 + \left(1 + \frac{a_1}{a_2}\right) P_4 - P_1 \frac{a_1}{a_2} \quad (6)$$

where

a_1 = area of engine piston, sq. in.
a_2 = area of pump piston, sq. in.

and other symbols are as in preceding formula.

Further deviation from the originally assumed set of conditions is the case when the production column contains considerable water. In such a case there is an unbalanced column pressure on the engine piston and the pressure on the pump piston is increased due to heavier column. The equation for the operating pressure therefore can be written:

$$\frac{a_1}{a_2}(P_1 + h_1 \times d_1 - h_1 \times d_2) = P_2 - P_3 + P_4\left(1 + \frac{a_1}{a_2}\right) \quad (7)$$

where

h_1 = height of operating column, feet, assumed to be equal to the height of discharge column
d_1 = density factor of power oil, lb. per sq. in. per ft.
d_2 = density factor of produced fluid, lb. per sq. in. per ft.

Pressure of the discharge column can be expressed in terms of height of fluid column and density:

$$P_3 = h_1 \times d_2 \quad (8)$$

Substituting in the preceding equation and solving for submergence pressure:

$$P_3 = h_1 \times d_2 + P_4\left(1 + \frac{a_1}{a_2}\right) - \frac{a_1}{a_2}[P_1 - h_1(d_2 - d_1)] \quad (9)$$

Above given equations, determined for static conditions, did not consider friction. For pump in actual operation proper friction correction factors have to be applied:

$$\frac{a_1}{a_2}(P_1 - f_1 - f_p + h_1 d_1 - h_1 d_2) = h_1 d_2 - P_2 + P_4\left(1 + \frac{a_1}{a_2}\right) + f_2\left(1 + \frac{a_1}{a_2}\right) \text{ or} \quad (10)$$

$$P_3 = h_1 d_2 + \left(1 + \frac{a_1}{a_2}\right)(P_4 + f_2)$$

$$\frac{a_1}{a_2}[P_1 - h_1(d_2 - d_1) - (f_1 + f_p)] \quad (11)$$

where

f_1 = friction loss, power oil
f_2 = friction loss, produced oil
f_p = fluid and mechanical friction in subsurface unit

This is a general equation covering all contingencies. In actual practice a case occurs quite often when $d_1 = d_2$, $a_1/a_2 = 1$ and $P_4 = 0$. For such a case the above equation reduces itself as follows:

$$P_3 = P_2 - [P_1 - (f_1 + f_p + 2f_2)] \quad (12)$$

The friction factors are difficult to calculate since they are a function of viscosity, while viscosity is a function of temperature. Friction, however, can be determined by field tests. Such determination of friction requires solid fluid column in production tubing. Production at the well head is throttled, putting back pressure on the production tubing, and the changes in operating pressure are noted. Solid fluid column is assured when the operating pressure increases in ratio of 2 to 1 in relation to the increasing back pressure.

With solid fluid column in the production tubing several operating pressures readings are taken for different pump speeds. The readings have to be taken rapidly to insure constant fluid level. The operating pressures, increasing with increased speed of pump, are plotted against the strokes per minute. The curve projected to zero, gives the operating pressure without the friction factor. Values are substituted in Equation 9 to determine the bottom-hole pressure. The estimated density of fluid must be corrected for temperature and compressibility. The average of bottom-hole temperature and discharge temperature approaches quite closely the weighted average mean temperature of the fluid column. The compressibility is not a large factor. The water content must also be considered.

For normal operating speeds and viscosities the friction is mostly a result of turbulent flow. By plotting the operating pressure, as secured in friction tests, described above, against the square of speed the relation will be obtained in form of a straight line. If data of this type are secured for two rates of production, the productivity index can be read directly from the chart. It equals the difference in rates of production divided by pressure difference for given pump speed.

Once bottom-hole pressures are determined by use of Equation 9 for two different rates of production, the well's potential can be calculated by methods outlined in Installment 2 of this series.

Other Indications

The above outlined method of determining bottom-hole pressures is not sufficiently accurate to replace bottom-hole measurements made with standard methods. It is useful as a quite close estimate. Its main usefulness, however, lies in its application for indication of changes in bottom-hole conditions.

The bottom-hole pressure and productivity may be determined with a standard bottom-hole gage and results of the survey correlated with results of the above method. Then, for the same conditions of speed, back pressure, water content of fluid, etc., as used in the comparison, the changes of operating pressure are a direct indication of the change of the bottom-hole pressure. Thus, if at certain operating conditions of speed, back pressure, etc., the operating pressure has certain value and later, after the operating conditions have been adjusted again to the standard conditions of comparison, the operating pressure shows an increase, this increase reflects directly the decline in bottom-hole pressure.

The operating pressure may be also used as an approximate indication of the fluid level of the well. As previously stated, the operating pressure, in pounds per square inch, equals, depending on water content of the produced fluid, from 40 to 50 per cent of the lift, in feet. Therefore, the operating pressure is a direct, approximate, indication of the fluid level. Above relation between fluid level and operating pressure is valid only for subsurface unit with 1:1 ratio of the engine piston to the pump piston.

Pulsation of the gage serves as a good indication of the manner of operation of the subsurface pump. Two pulsations occur during each stroke. Fig. 1 shows characteristics of these pulsations for different conditions. Under (a) pulsation is shown corresponding to the pumping of solid fluid, (b) indicates slight pound, and (c) severe pound.

Special Applications

Reference has been made to the

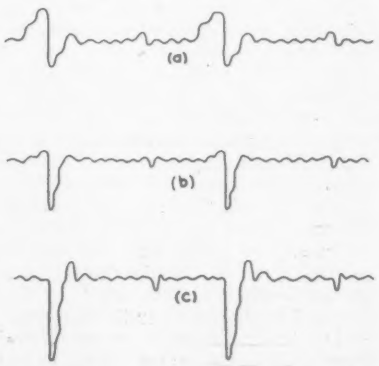

Fig. 1—Gage pulsations as an indication of subsurface pump performance in a hydraulic pumping installation. (From "Estimation of Bottom-Hole Pressure From Hydraulic Pump Operating Data," C. J. Coberly)

flexibility of the hydraulic pumping system, which flexibility makes this system applicable to widely varying operating conditions. Before completing discussion of the hydraulic method of pumping, certain special applications should be mentioned, for which the hydraulic system is particularly adapted.

While deep-well hydraulic pumping should not really be considered a special application, since it is used quite widely for this purpose, nevertheless use of hydraulic pumping in very deep wells must be included under this heading. Lack of movement of tubing, due to pulsation, efficiency of power transmission to the great depths, elimination of heavy string of rods, make the hydraulic pumping particularly suitable for operation in deep wells.[3,4]

Since, in case of a multiple installation, the gages and control valves are usually located at the central power plant, the hydraulic system is particularly adapted for installations, where the access to the individual well locations is difficult. Check and inspection of the operation of individual wells can be made in one central location, eliminating the need for frequent trips of the pumper to the wells.

Another important special application of hydraulic pumping is its use in wells, with high degree of deviation from vertical. The difficulties of pumping crooked holes with standard methods are well known. Wear of tubing, failure of rods and other equipment, increased power to overcome friction result jointly in the increased production cost per barrel, which in many cases may become prohibitive. Since in case of hydraulic pumping there are no moving parts throughout the length of tubing, the degree of straightness of the hole does not have any appreciable effect on the efficiency and cost of pumping.

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3. Harry F. Simons: "Wells Below 9,000 Ft. Pumped by Hydraulic Methods," The Oil and Gas Journal, June 5, 1941.
4. Neil Williams: "Hydraulic Pumping Is Applied to Deep Wells on Gulf Coast," The Oil and Gas Journal, June 25, 1942.

Electric Flasher for Pump Warning

THE presence of the boiler fireman on a rotary rig is often required for considerable length of time on the derrick floor. During trips or breakdowns the fireman will assist in the work and will be away from the boilers. Generally during such periods, the boilers are lightly loaded and the water-feed pump is run slowly. An experienced fireman can regulate the water feed so the water level in the boiler is maintained at the desired point. However, the water-feed pump must be run so slowly in some cases that there is danger of its stalling. In order to check the operation of the pump from the derrick floor, firemen have used a number of arrangements. One of the more practical is a flasher switch operated by the rocker arm which turns a light atop the boiler shed on and off. As long as the pump is operating properly, the light comes on and goes off at regular intervals. If it fails to come on, or if it stays lit, the fireman knows the pump has stopped.

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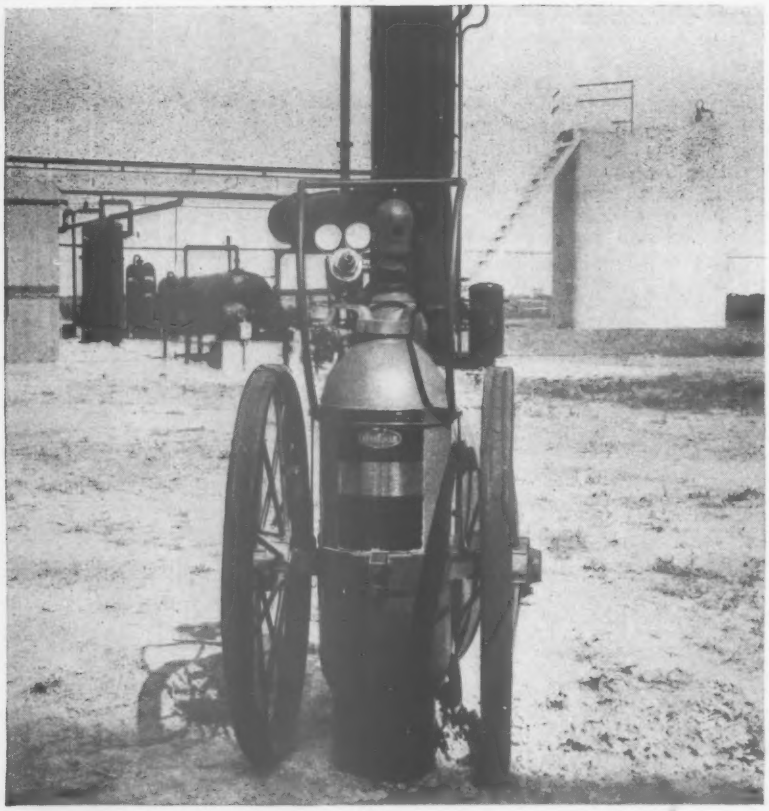

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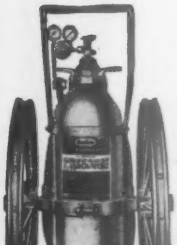

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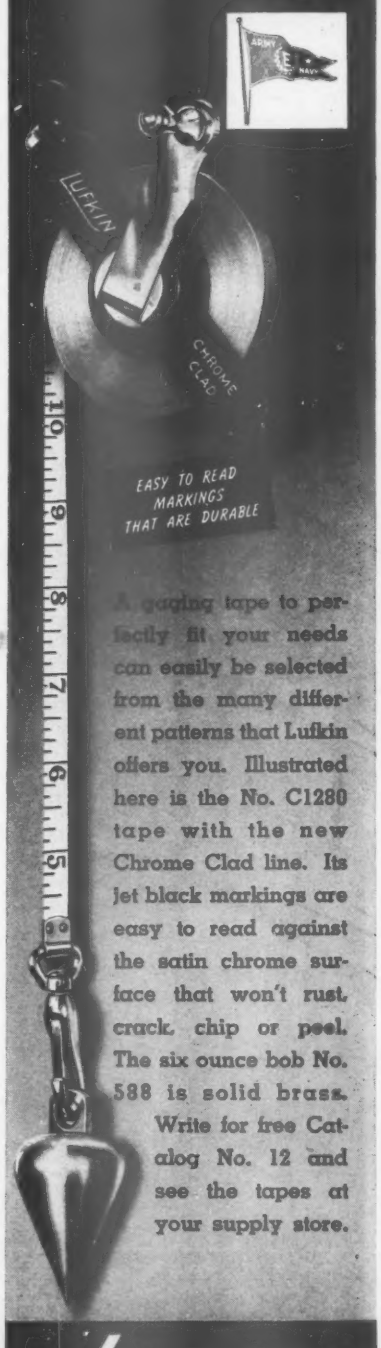

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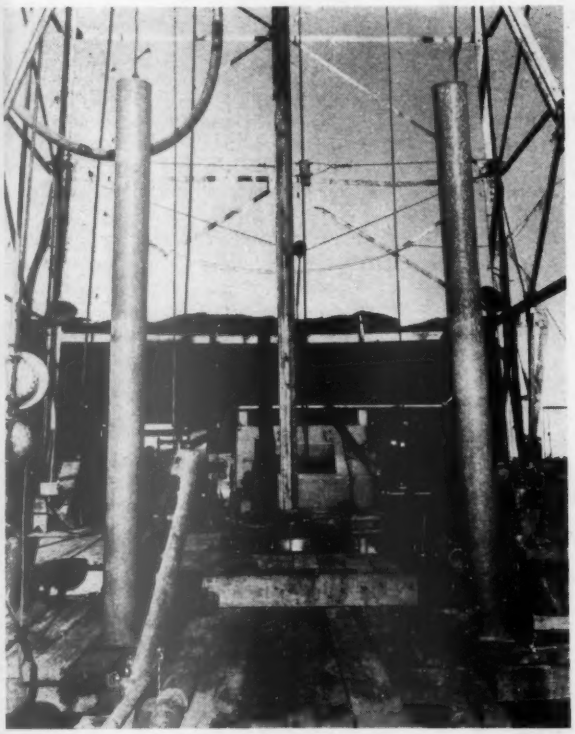
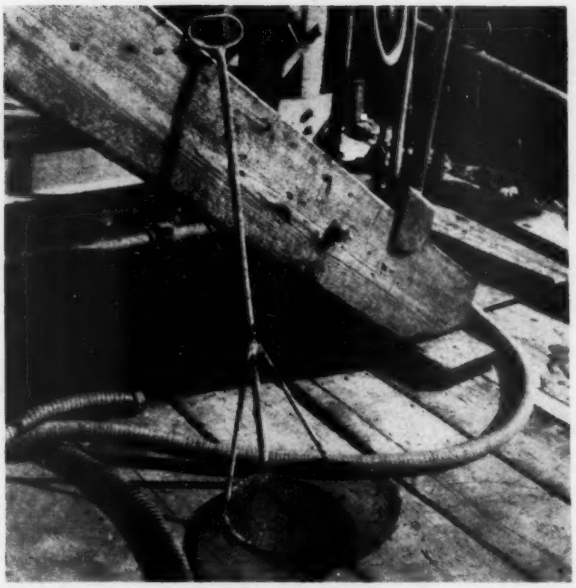


Enclosed Tong Counterbalances

COUNTERBALANCES used on the pipe tongs on rotary-drilling rigs must be arranged to have considerable travel as it may be desired to operate the tongs anywhere between floor level and 10 ft. above the rotary table. This creates a source of danger as the workmen may be struck by the counterbalances when they are lowered as the tongs are raised, or they may (as frequently happens) walk into them. Another common accident is for a workman to stoop over to pick up some piece of equipment and then strike the counterbalance with his head as he resumes a standing position. There are a number of ways of eliminating or preventing such accidents. One method is to enclose the counterbalances in large-diameter, lightweight casing placed in a vertical position at the side of the derrick. A base welded to the casing is bolted to the floor and holds the casing in position; the top should be attached to the derrick in some manner. Any tendency of the counterbalance to bind and not move freely inside the casing can be overcome by the application of a lubricant.

Skimmer for Suction Pit

DEBRIS often gets into the slush pit and is eventually washed to around the pump suction. If any of this debris gets into the pump it generally lodges under the valve seats and causes severe pounding and overreaching



of the pump pistons, or clogs the strainers in the pump or around the foot valve. A skimmer for removing this trash from around the suction can be made from ¾-in. sucker rod with a handle on one end and a circle covered with screen on the other. The screen is dished so it has the form of a net and particles cannot fall off of it. If a number of small particles are in the mud the screen can be held over the pump suction and after the debris has collected the skimmer can be lifted and the material shaken free.

Steam-Line Sample Dryer

DRYING of cutting samples often presents some difficulty to the drilling crew, particularly during warm weather when no derrick stove is in operation. One driller constructed a shallow and bottomless box with ends and sides closely fitting the steam line. Samples spread out in this box are mostly in contact with the steam line and dry quickly. Rotating the box around the steam line makes a chute out of one side so the cuttings can be easily emptied into the customary sacks. The box is held on the steam line by a piece of sheet metal tacked to the sides.

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• • • • •

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Design of Electrical Circuits For Low-Voltage Protection in Start Button Control Hook-Up

*by L. E. Markle**

Low-voltage protection is an important consideration in control circuits for starter pushbutton installations. In this article, the author defines some of the confusing terms used in pushbutton applications and describes the two types of control circuits. Rules for any combination of control sequence for low-voltage protection are outlines.

DEFINITION of terms used with pushbutton applications afford a foundation on which to build a few basic rules. Two terms that are sometimes confusing are low-voltage release and low-voltage protection.

Low-voltage protection allows all apparatus to be disconnected from the line if the power source fails or a disturbance occurs that causes the line voltage to drop to a very low value. In order to start the apparatus again, it is necessary to actuate the start button.

In order to obtain low-voltage protection, it is necessary to have a start button that closes the control circuit only when it is being held down. An electrical interlock that is closed when the control has functioned parallels the start button and keeps the control circuit closed after the start button is released. When the control drops out because of voltage failure, the interlock opens the control circuit, thus giving protection against unsupervised starts when power returns.

Low-voltage release, on the other hand, allows all parts to be disconnected from the line if for any reason the power source voltage is inadequate, but when the voltage again reaches sufficient value the control will function automatically to connect the apparatus to the line through the proper starting sequence.

*Control engineer, Westinghouse Electric & Manufacturing Co.

Types of Control Circuits

These two types of control circuits, commonly known as two and three-wire control, require different types of pushbuttons. The low-voltage release control circuit requires a pushbutton that remains closed until released by hand. This type of pushbutton is known as the maintained type, and the contacts are held closed mechanically.

Low-voltage protection is secured by a momentary-contact-type pushbutton. Fig. 1 shows the diagram for a low-voltage-protection pushbutton connection; Fig. 2, the diagram for low-voltage release.

A control button does one of two things—it either makes a circuit or breaks a circuit. Heavy-duty pushbutton stations are arranged so that either or both operations can be obtained on the same unit. This ability to make or break circuits is exceedingly useful when more than just the start and stop functions are desired.

Rules for Wiring

Any combination of control sequence for low-voltage protection can be obtained by applying these two fundamental rules:

1. Wire all stop buttons in series with the holding coil, with each other, and with the electrical interlock.

2. Wire all start buttons in parallel with each other and with the electrical interlock.

Limit switches have not been included in any of the diagrams, although they are frequently used. These switches are governed by the same rules that apply to pushbuttons—that is, in most instances the pushbuttons can be replaced by a limit switch. Switches normally closed are similar to stop buttons, and those normally open operate as start buttons.

In the accompanying diagrams number 1 has been used to designate the control circuit to the start button; 2, the point common to the start-stop button; and 3, the stop button. On some controls manufactured currently these same markings are used to aid in making common pushbutton connections. The holding interlock parallels the start button; therefore, in the schematic diagrams it is connected to points 1 and 2 of the pushbuttons.

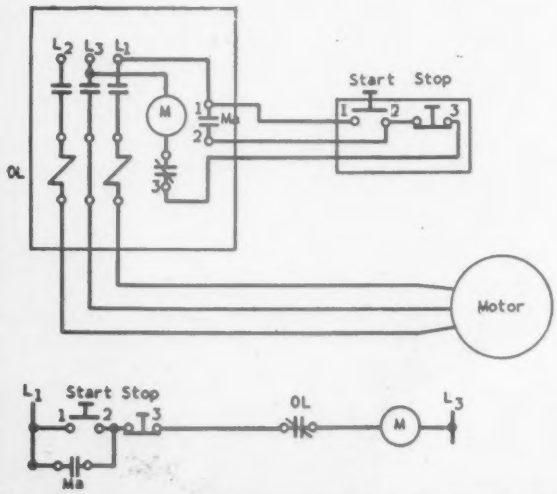

Fig. 1: Buttons: Two Momentary-contact, one closed, one open. Circuit: Low-voltage protection, single station. Duty: Start-stop

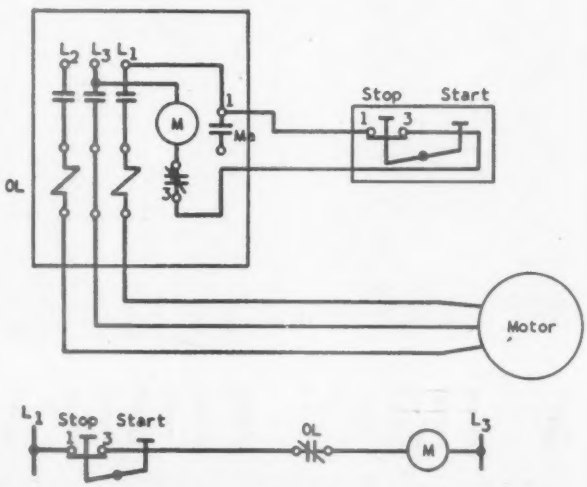

Fig. 2: Buttons: Two maintained-contact. Circuit: Low-voltage release, single station. Duty: Start-stop

ECONOMICS OF ENGINE COOLING

FAN units, or radiators, for cooling-water jackets of oil-well single-cylinder pumping engines have been found by operators to have profitable applications under certain conditions. Examples of conditions favorable to the use of coolers, instead of the conventional open wood or steel circulating tanks, are as follows:

1. Where the use of antifreeze is desirable or necessary.
2. Where cooling water is not readily obtainable.
3. Where expensive water systems or long lines must be provided.
4. Where water is available, but not suitable for engine cooling.
5. Where the labor situation is critical and a saving in attention to the engine can be effected by the use of an engine cooler.

The cost of an engine cooler, or radiator, depends upon the size, type, and brand of cooler selected. In the selection of a cooler the size, type, make, and model of the engine is to be considered. The load on the engine, as well as the operating speed, are also factors to take into account. Generally speaking, for engines ranging from 35 to 50 hp. in size, and used under average conditions, the cost of coolers, completely installed, will ordinarily range from $200 to $600 per installation.

Radiator Cooling Units

A radiator, or cooling unit, has advantages over the circulating tank in the prevention of scale in water jackets of pumping engines. The addition of large quantities of water to an open circulating tank increases hardness and causes scaling. The makeup water to a closed cooling system is comparatively small and water hardness is kept at a minimum. Consequently, a reduction in engine "boil-out" jobs may be anticipated with the use of engine coolers. More effective control of water and engine temperatures is possible with the use of coolers. This may bring about more efficient engine operation with a resultant reduction in engine repair expense.

In the event it is necessary to replace the cooling facilities at an old installation a study of the economics involved should be made in deciding a course of action. For a 40-hp. engine an estimate of comparative replacement costs are as follows:

1. Cut down old and rebuild new 250-bbl. wood circulating tank	$175
2. Replace 250-bbl. wood circulating tank with welded steel tank	225
3. Remove circulating tank and install engine cooler	500

A wide variety of conditions are found at different wells and installations. Some of the more typical ones are described below.

Cooling Applications

Situation No. 1.—If there is available an ample supply of water of satisfactory quality, if there is nothing to be gained by the use of antifreeze, and repairs to the engine and cooling system, because of inadequate cooling, have not been excessive, the continued use of a circulating tank is good economy.

Situation No. 2.—If conditions are the same as are described under Situation No. 1 but if a quantity of needed material, such as water lines and a water pumping unit, can be salvaged by the use of a cooler the value of such equipment should be compared with the extra cost of installing cooler and action taken in accordance with the finding. Consideration should also be given to the fact that future repairs to the water pumping unit and lines salvaged would be eliminated.

Situation No. 3.—If the quality of cooling water available is poor which has caused frequent boil-out jobs because of lime and scale, if piston-ring replacements and other repairs have been execessive because of inadequate engine cooling a careful analysis of expense should be made in an attempt to estimate damage that h occurred because of faulty coolin An estimated payout of the use a cooler can then be calculated.

Situation No. 4.—If the engine operated part time in an area whe antifreeze is needed the advanta of relief from the necessity of fr quent engine drainage should be co sidered. In isolated areas, where e gines operate part time, some oper tors use automatic shut-down devic to save trips to the wells. With su installations freezeups can be elim nated by the use of antifreeze.

Care of Cooling System

Repairs to engine coolers are ge erally not expensive. However, a re sonable outlay for their upkeep shou be anticipated. If the engine jacket thoroughly cleaned before installatio if a good quality of water is used, if scale trap is employed and flexib connections are used between cool and engine to avoid transmission engine vibration to the cooler, t cooler should operate indefinite without repairs. An inhibiter may necessary to keep the water in prop condition.

For efficient operation the tempe ature differential across the cool should not be too high since abnc mally high differences in temperatu of the water in the engine jacket w set up stresses in the engine cylind and jacket. A difference between t inlet and outlet water probably shou not exceed 20° F. A bypass therm stat which controls the temperatu by allowing hot outlet water to ent the intake may be desirable in e tremely cold regions. Fan speeds c be regulated to provide for more c sirable temperatures. A temperatu safety switch, to shut down the e gine when the water goes above certain temperature is often used. F efficient engine performance m operators attempt to keep the wa jacket outlet temperature from 1 to 150° F.

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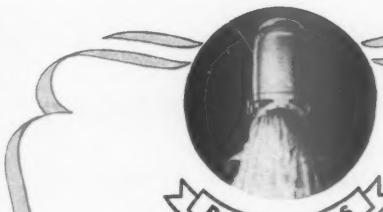

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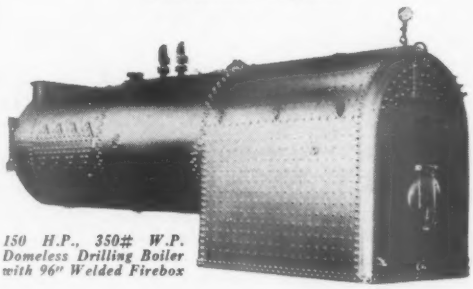

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CHEMICAL TREATMENT OF MUD FOR CEMENT CONTAMINATION

WHEN ordinary bentonitic drilling mud is contaminated with cement, the mud viscosity and gel properties increase markedly and wall-building properties of the mud may become very poor as evidenced by a high water loss and thick filter cake. Such contamination often occurs in drilling cement after setting casing or following a squeeze job. Generally, the effect is more pronounced if the cement has not set thoroughly.

The increased viscosity and poor wall-building property of cement-cut mud can be attributed to flocculation of clay colloids by calcium hydroxide, $Ca(OH)_2$, in the cement slurry. The calcium hydroxide is alkaline and will cause a decided rise in the pH value of the mud.

In certain localities, mud-making bentonitic shales are encountered which disperse rapidly into the mud and increase the viscosity. It has been found that the dispersion of some of these shales into the mud is much more rapid when the pH value is high.[1] For this reason, it is desirable in such a locality to not only restore the viscosity, gel properties, and wall-building properties to their values before cement contamination, but also to restore pH to its original value. Proper attention to choice of treating chemicals makes it possible to restore all of these mud properties.

Calcium ions from the calcium hydroxide in the cement slurry replace sodium ions on the clay particles; thus, the sodium-bentonite is converted to a calcium bentonite. This reduces the degree of dispersion and hydration of the clay particles,* and many of the individual clay particles combine to form larger aggregates. These changes in the state of the colloidal particles are evidenced by the observable changes in viscosity, gel properties, and wall-building property that have already been mentioned. Release of hydroxyl (OH) ions, into the water phase of the mud, by the calcium hydroxide is responsible for the increase in pH value of the mud. This increase in pH value, in itself, causes a rise in the gel strength of the mud* and adds to the trouble.

*See Installment 133.

Chaney[2] states that the following results must be accomplished in treating cement-contaminated mud:

1. Remove the calcium ions as an insoluble precipitate.
2. Reduce the pH to approximately the value before contamination.
3. Redisperse the clay aggregates as much as possible.
4. Replace with fresh clay any colloidal material that cannot be restored readily to its original condition.

The first three of these aims can be accomplished simultaneously; while the fourth is not begun until the pH has been reduced to the proper value.

One treatment suggested by Chaney is to add a mixture of about equal proportions of monosodium orthophosphate (NaH_2PO_4) and one of the complex phosphates. Sodium hexametaphosphate, $(NaPO_3)_6$, is suitable as the complex phosphate. The monosodium orthophosphate reacts with the calcium hydroxide to form sodium hydroxide (soluble in water) and insoluble calcium phosphate which drops out as a precipitate. Additional monosodium orthophosphate then reacts with the sodium hydroxide to form disodium phosphate, Na_2HPO_4.

Since the sodium hydroxide, formed as an intermediate product, is strongly alkaline, the pH value of the mud will not materially decrease until this first reaction is complete. It is possible then, by watching for a sharp decrease in pH, to determine when complete precipitation of the calcium is accomplished.

The complex phosphate (say sodium hexametaphosphate) used as the other half of the treating chemical acts as a deflocculating agent to break up the aggregates of clay particles.

Addition of the chemical mixture is continued until the pH value is lowered to the desired point. At this stage, it may be necessary to reduce the proportions of complex phosphate in the treating chemical in order to prevent too great a reduction in viscosity. It is evident that proper control of the treatment requires frequent checks on the pH value and viscosity. After restoration of the viscosity and pH, the wall-building property can be improved, if necessary, by addition of bentonitic clay. Addition of such clay may require also the use of a "thinner" (complex phosphate, for example) to keep the viscosity low enough.

A similar treatment, using acid pyrophosphate ($Na_2H_2P_2O_7$) instead of the mixture of monosodium orthophosphate and complex phosphate, will accomplish the desired result. Sodium acid pyrophosphate has a pH value of about 4.8. It has a sharp deflocculating action on the clay particles, will precipitate the calcium ion, and at the same time reduces the pH value of the mud.

Similar treatments are possible. The guiding principle is to use any acid having an insoluble calcium salt, in order to precipitate the calcium, and a deflocculating agent to redisperse the clay particles. Pyrophosphoric acid ($H_4P_2O_7$) and sodium dihydrogen orthophosphate (NaH_2PO_4) can be used. Exact proportions and procedure of using these chemicals should be determined by test, using small samples, before making additions to the entire system.

These treatments are designed for use particularly in areas where it is desirable to keep the pH value low, for example, where bentonitic shales are to be penetrated. It will be noted that none of the treatments already suggested are based upon the precipitation of calcium as a carbonate. Calcium carbonate is essentially insoluble and would precipitate, but at low pH values (below 8.5) it has been observed that there is a tendency for the carbonate to be converted to bicarbonate. The calcium bicarbonate is soluble in water, and thus when it is desirable to keep the pH low, the calcium ion would not be completely precipitated by this treatment.

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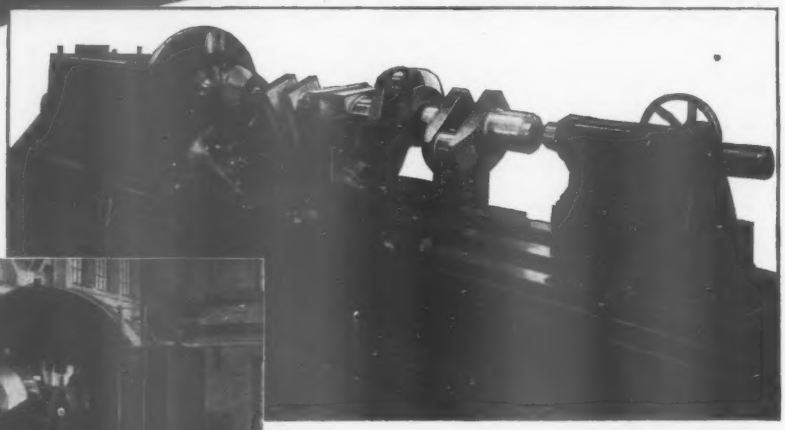
1. Garrison—"Surface Chemistry of Clays and Shales," A.I.M.E. Pet. Dev. and Tech. 1939, pp. 191-203.

2. Chaney—"A Review of Recent Advances in Drilling-Mud Control," A.P.I. Dr. and Prod. Pract. 1942, pp. 31-46.

3. Stern—"Role of Clay and Other Minerals in Oil-Well Drilling Fluids," R.I. 3556, U.S. Bureau of Mines.

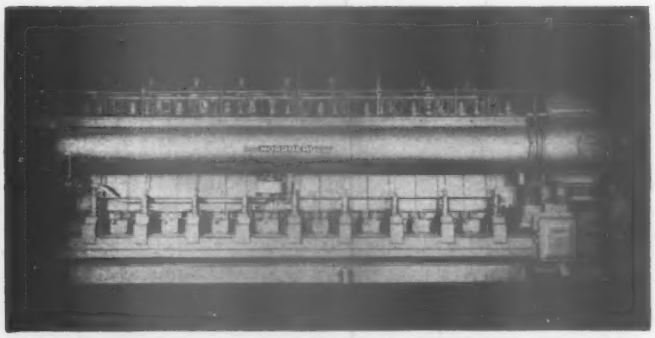
Series prepared by Glenn M. Stearns, associate professor of petroleum engineering, University of Oklahoma

Facilities for building ...G DIESELS



The largest crankshafts can be turned on this 84 inch lathe.

This 72 inch lathe for turning crank pins is one of the largest in this country.



Many of these nine cylinder 3600 horsepower Nordberg Diesel engines are in stationary and marine service.

These two lathes are typical of large and specially designed equipment installed by Nordberg for the building of Diesel engines. In addition to modern machine tool equipment and manufacturing facilities, there is that Nordberg experience — that "know-how" — which has been acquired through many years of building Diesel engines and other types of high grade power machinery. Plant facilities, trained personnel and experience now serving to produce Diesel engines for wartime needs will in the postwar period again provide the dependable and economical Nordberg Diesels required for peacetime needs.

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NORDBERG
DIESEL ENGINES

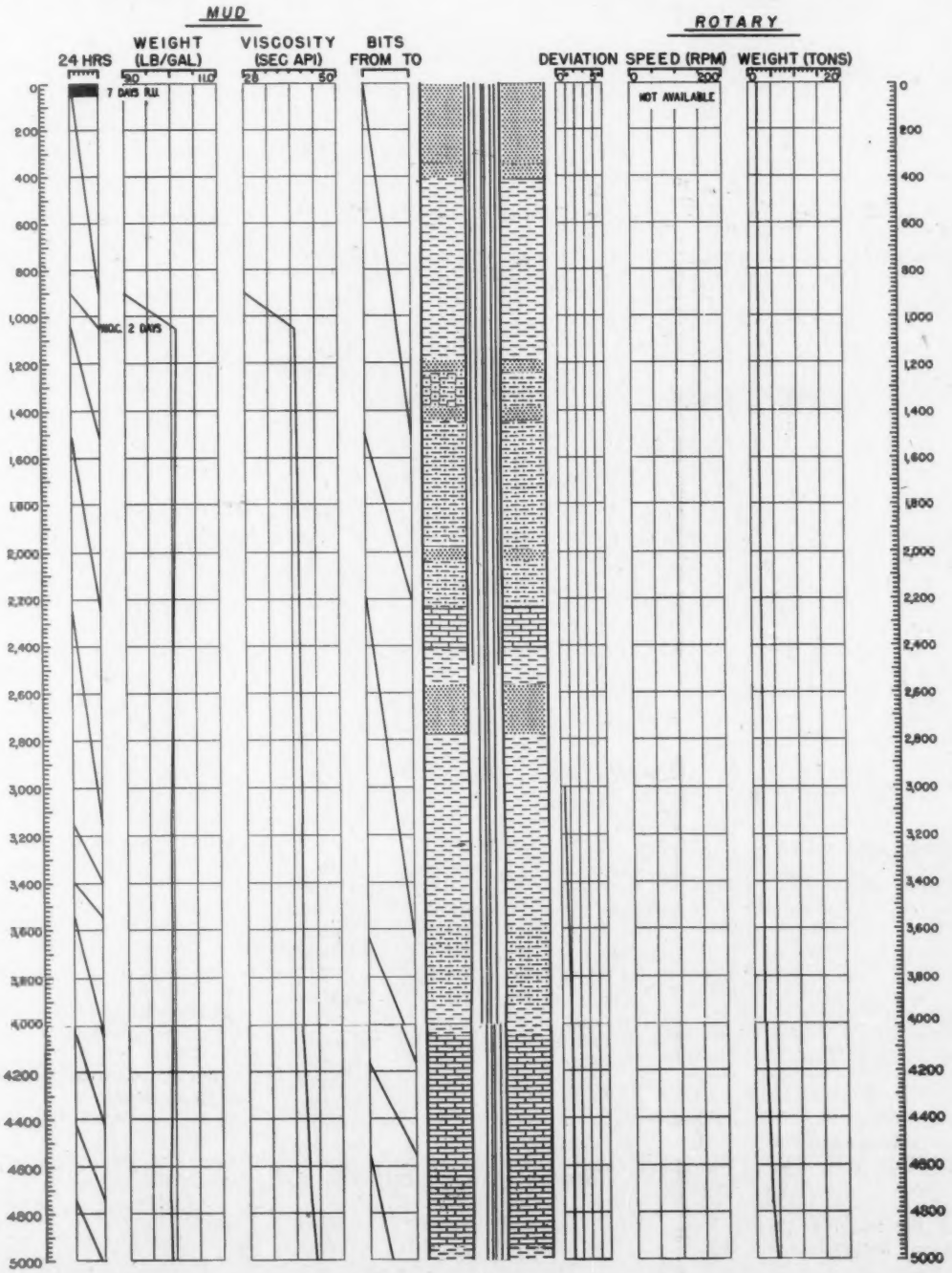
Discovery Well, Runge Field, Karnes County, Texas

ARKANSAS FUEL OIL CO. 1 E. E. LYONS

662 ft. from east line and 648 ft. from south line, D. C. Lyons Survey, derrick floor elevation 258 ft.

CONTRACTOR

T. G. & M. Drilling Co.



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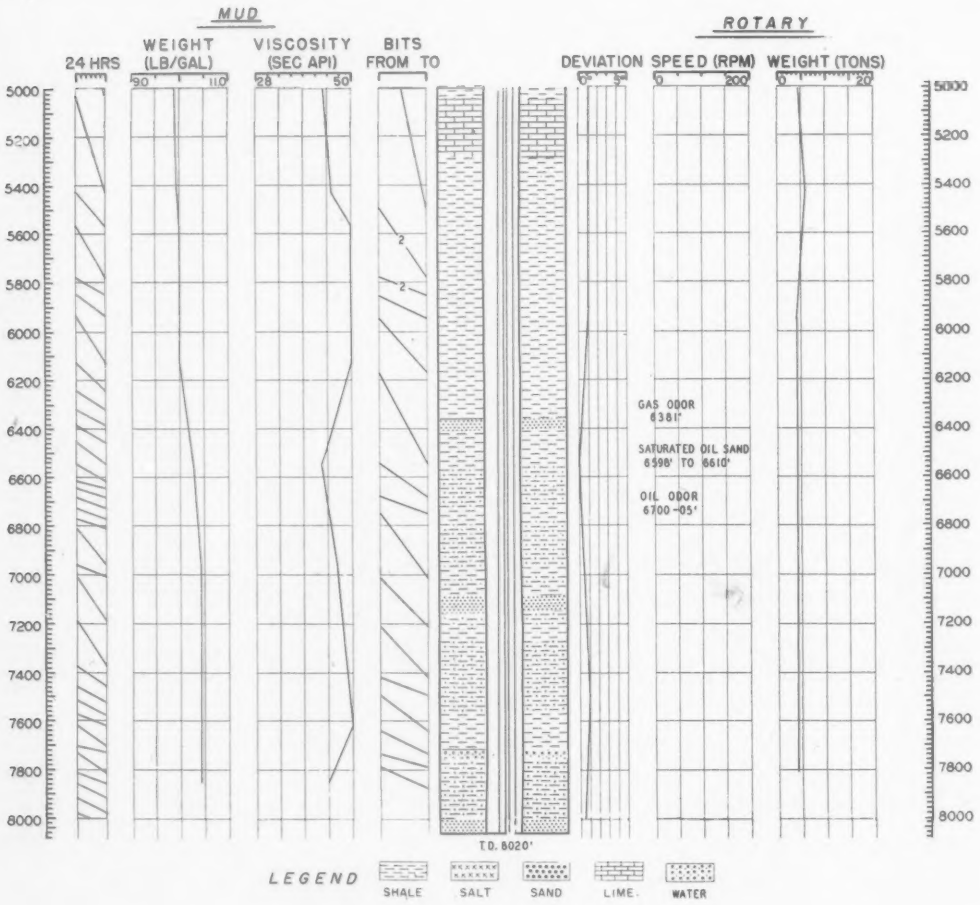
Journalog

Discovery Well, Runge Field, Karnes County, Texas (Continued)



DRILLING DATA

Started rigging up	9-30-43
Completed	10- 6-43
Type rig	Rotary
	Hours
Rotary time	504½
W.O.C.	168
Run casing (surface)	16
Logging (electric)	24
Coring	294
Reaming	61
Circulating	9
Drill-stem test	8
Breaking down pipe and running oil string	24
Trips	160½
Repairs	8
Shutdown, fishing	19
Plug back and testing	240

BITS USED

Type	Number	Size
Fish tail	1	15½-in.
Fish tail	12	9⅞-in.
Rock	11	9⅞-in.
Core heads	9	6¼-in.

MUD USED

Type—	Amount
Aquagel	205 sacks
Barcid	800 sacks
Unavis	9 cases
Stabilite	21 sacks
Quebracho	18 sacks
Homco	100 sacks
Drilling clay	100 sacks

CASING AND TUBING

Size (in.)	Weight (lb.)	Depth (ft.)	Cement (sacks)
10¾	32.75	1,023	600
5½	17.00	6,779	600
2⅜	4.70	6,600	

PRODUCTION TEST

Casing perf., ft.	6,595-6,608
Size shots, in.	½
Number shots	71
Time flowed, hours	24
Choke, in.	¾
Tubing pressure, lb.	40 to 140
Casing pressure	Sealed
Separator pressure, lb.	20
Oil, bbl.	132
Water	None
Gas, cu. ft.	41,200
Gas-oil ratio	343 to 1
Gravity, °	38.5
B.H.P., lb.	2,775

. . . for Production

KAY TYPE STEEL DERRICKS . . . SUB-STRUCTURES . . . ENGINE FOUNDATIONS . . . STAIRWAYS . . . LOADING RAMPS . . . PIPE RACKS . . . TOOL HOUSE SUPPORTS . . . JACKKNIFE CANTILEVER DRILLING MASTS . . . TRUCK MOUNTED MASTS . . . SERVICING MASTS . . . REDHEAD PUMPING UNITS . . . PUMPING UNIT ACCESSORIES . . . PUMPING UNIT ENGINES and MOTORS . . . NON-SKID GRATING . . . STANDARD CABLE TOOL RIGS and ACCESSORIES.

Redhead Pumping Units available in 5, 9, 14, 21 and 28 H. P. Double Reduction — Twin Crank Units with beam and/or crank counter weights. A "fool-proof" chain tightening device, incorporated in the larger units, enables quick adjustment in the field.

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QUESTIONS on TECHNOLOGY

by W. L. Nelson

Pressure Caused by Wind

What is the force with which wind pushes in a storm? I have heard of a force of 25 lb. per sq. ft. of surface.—G.H.P.

A wind pressure of 25 lb. per sq. ft. is a common figure, but it is a very conservative one. According to V. O. Marshall[1] the U. S. Weather Bureau recommends the following formula:

$$p = 0.004 \frac{B}{30} V^2$$

in which:

p = wind pressure, lb. per sq. ft.
B = barometric pressure, in. mercury
V = wind velocity, m.p.h.

This formula gives values that are higher than fundamental theory would indicate, by an amount of about 57 per cent.

Fundamentally the pressure should be equal to or less than the velocity head of the fluid. If the motion of the air were completely stopped by a flat wall or surface, the head or pressure on the wall would be

$$h = \frac{u^2}{2g} = \frac{u^2}{64.4}$$

in which:

h = pressure expressed as feet of fluid
u = velocity in ft. per sec.
g = force of gravity, 32.2 in these units

Introducing the units of the U.S. Weather Bureau:

$$\frac{379 \times \frac{30}{B} \quad (V \times \frac{5280}{3600})^2}{28.9} p = \frac{}{64.4}$$

$$p = 0.00255 \frac{B}{30} V^2$$

Temperature is usually more important than barometric pressure, and hence if great precision be desired, the temperature (°F.) may be introduced, this

$$\frac{379 \times \frac{30}{B} \times \frac{t + 460}{250} \quad (V \times \frac{5280}{3600})^2}{28.9} p = \frac{}{64.4}$$

$$p = .00255 \frac{B}{30} \times \frac{520}{(t + 460)} V^2$$

$$= .0442 \frac{B}{(t + 460)} V^2$$

An explanation of the larger values given by the weather bureau is the gustiness of the wind. Gusts of wind in excess of the average velocity by 25 to 57 per cent would account for the difference. Fig. 1 is based on the

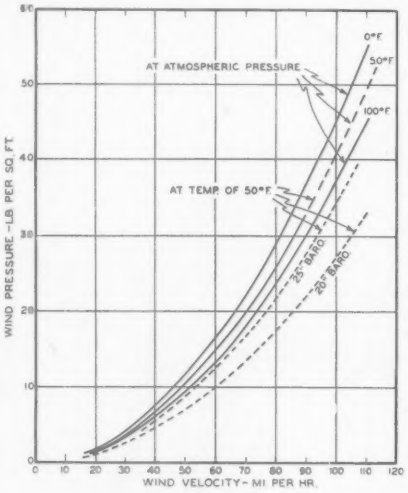

Fig. 1

weather bureau formula and a modification of it which involves the effect of temperature on wind pressure.

In a general way, the pressure by the theoretical consideration should be larger than the actual case, in other words, it should be conservative. This is based on the fact that some of the kinetic energy of the wind would, in the actual case, be consumed by eddy currents, turbulence, etc., and would thus not be applied against the surface.

Wind velocities in the Southwest seldom exceed 70 miles per hour but velocities of 100 miles per hour are sometimes registered on the coasts. Even higher velocities are encountered in tornadoes and other freak wind conditions, but such conditions create pressures that are so large that structures are usually not designed to withstand them.

Reference

1. V. O. Marshall, "The Design of Foundations for Stacks and Towers," Petroleum Refiner, August 1943, page 101.

How Many Plates Required For Solvent Fractionation

We have a real problem that is like your question in The Oil and Gas Journal of March 16, 1944. How many plates are required to separate solvent naphthas, such as rubber-cement solvent and cleaner's naphtha?—D. A. F.

Rubber-cement solvents range all the way from a 95°-185° F. material to a 300°-370° material, and somewhat the same is true of cleaner's naphthas, but it is assumed for purposes of illustration that the naphthas have 50 per cent boiling points of 250° and 350° F. Naphthas usually have extremely narrow boiling ranges and hence, it would usually be necessary to make another naphtha between the two that are desired in order to confine the main boiling ranges to 50°-80° F. Even with the intermediate product, the separation is not an easy one.

Computations of the exact number of trays and amount of reflux required are extremely laborious, and although the method of Clark (J. W. Packie, Trans. Am. Inst. of Chem. Eng., Vol. 37, page 51, 1941) does not pertain directly to this situation, it has been used as a means of getting some idea of the requirements. For stocks not stripped by steam and having no gap between the 5 per cent point of the high-boiling material and the 95 per cent point of the low-boiling material, the product of the reflux ratio and the number of plates is very large amounting to 150 or 200. This means that the following numbers of plates and amounts of reflux might be employed:

No. of plates	Reflux ratio
10	15-20
20	7.5-10
30	5-7

Even these rather large amounts of reflux or large numbers of trays do not give an extremely narrow boiling-range product. The A.S.T.M. distillation curves of the products would be somewhat as follows:

A.S.T.M. DISTILLATION CURVES (APPROXIMATE)

	Rubber cement (°F.)	Intermediate (°F.)	Cleaner's naphtha (°F.)
5 per cent	225	275	325
10	230	280	330
50	250	300	350
90	270	320	370
95	275	325	375
End point	295	345	395

The boiling range can be narrowed even more by vigorously steam stripping the products (both the top and the bottom), particularly if the strippings are collected as separate or slop products. In this manner almost a complete gapping of the boiling ranges (initial boiling point and end point) might be attained.

REFINING

British-American Adds to Its Refining Facilities

TORONTO.—British American Oil Co. has installed additional processing and auxiliary equipment at its Moose Jaw, Sask., refinery for the production of aviation gasoline. Equipment has been installed also in its Turner Valley absorption plant and its Calgary refinery to supply feed stocks or raw materials to the government-sponsored alkylate plant at Calgary. Similar installations recently have been completed at Montreal to supply feed stocks to the government alkylate plant at that point. The company's new refinery at Clarkson, near Toronto, designed to supply aviation gasoline and aviation and industrial lubricants, has been in continuous operation since November 15.

Taber Field Crude Trucked To Refinery in Lethbridge

LETHBRIDGE, Alta. — Providing a partial outlet for the 1,400-bbl. daily potential production of the Taber field, now virtually shut in, crude from that field is being moved by truck to the refinery of Pacific Oil & Refining Co. here. The plant, which has been shut down, is expected to resume operation soon.

Sinclair's Cracking Unit in Wyoming Now on Stream

SINCLAIR, Wyo.—Sinclair Refining Co.'s new fluid catalytic-cracking unit, designed with sufficient flexibility to produce high yields of aviation base stock and feed stock for alkylation purposes, is now on stream. The unit, constructed by M. W. Kellogg Co., may be operated on a single-pass basis, or the cycle stock may be returned to the reactor for producing increased yields of base stock and alkylation feed stock, depending on the availability of gas-oil charge. The unit is designed also for retreating of the single-pass material boiling in the aviation range if desired, and is capable of handling high boiling distillate and residuum stocks for aviation-gasoline production.

The unit is complete with the necessary catalyst reservoir and compressors for discharging the gas to the refinery gas-recovery unit. Problems

Sketches of Plant Operators

CARL ORRISON, superintendent of Frontier Refining Co.'s Plant 1 at Cheyenne, Wyo., got his first taste of the work as a sample boy for National Refining Co. at Coffeyville, Kans., after finishing grade school in 1920. He attended high school while working nights in the National laboratory and joined Continental Oil Co. at its Glenrock, Wyo., refinery in 1924 as a stillman and treater. Transferred to the company's Sapulpa, Okla., plant in 1925, he advanced to the position of night superintendent.

Orrison became superintendent of the Dickey Refining Co. plant at McPherson, Kans., in 1933, and when this property was purchased by Bay Petroleum Corp. in 1937 he was transferred to the Bay plant in Denver. He was superintendent there until 1939, when he was moved back to McPherson. He joined Crown Central Petroleum Corp. at Houston in March 1943, taking the position of assistant superintendent and he left that post to take his present position with Frontier.

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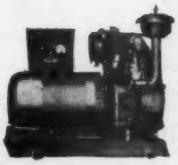
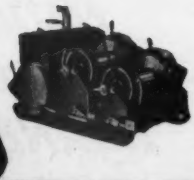


EASY TO OPERATE • WRITE FOR CATALOG



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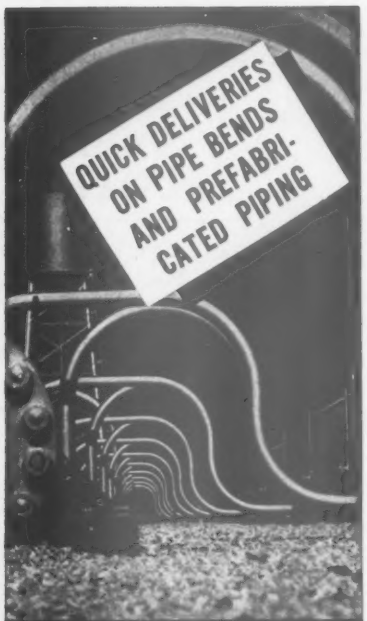

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encountered in designing this unit included the extremely low temperatures prevailing in Wyoming during the winter months. To counteract the cold it was necessary to provide housing for certain instruments and controls that normally are left out in the open.

Gulf Coast Plants Continue To Operate at High Rate

HOUSTON.—Total daily throughput of 111,237 bbl. of crude is reported by Gulf Coast Refiners Association for the 11 operating companies in the first half of April, an increase of 31,000 bbl. over the figure recorded in the corresponding period of 1943. Current operation is 91.5 per cent of rated capacity, against 55 per cent last year, when refiners were working under rigid restrictions with respect to charging rate and yields.

Stocks of all grades of gasoline continued to drop during the first half of April, reported at 1,359,504 bbl., a decline of 98,000 bbl. during the past month. A year ago total gasoline stocks held by refiners in the association were 2,415,525 bbl., or roughly 1,000,000 bbl. more than the current inventory.

Kerosene stocks at 149,939 bbl. April 15 indicate little change. Diesel gas-oil stocks were 36,558 bbl., a 34,-000-bbl. decrease.

Stocks of various grades of gas oil increased from 1,031,446 bbl. on March 15 to 1,055,335 bbl. on April 15. Stocks of the heavier fuels continue low, with No. 5 fuel oil reported at 224,143 bbl. and Bunker C fuel oil at 390,552 bbl.

Total stocks of all products was reported at 3,389,631 bbl., compared to total stocks of 4,280,532 bbl. last year, when crude runs to stills were at a much lower rate.

Whitehorse Refinery Now Ready to Produce Fuel

WHITEHORSE, Y. T.—The Whitehorse refinery, part of the U. S. Government financed Canol project and linked to its crude supply at Fort Norman by a 595-mile pipe line, was officially opened April 30 with ceremonies in which Canadian and American officials took part.

"Canol stands as one more example of United States-Canadian cooperation," said Prime Minister W. L. Mackenzie in a message addressed to Brig. Gen. Ludson D. Worsham, commander of the Northwest Service Command and responsible for construction of the project. The project, Mackenzie said, "was undertaken as an emergency measure when enemy action threatened the lines of supply to United States forces in Alaska." The message was read by Maj. Gen. W. W. Foster, special commissioner for defense projects in Northwest Canada, who represented the Canadian Government.

The project consists of the wells at Norman, construction of a road and pipe line from the field to the refinery, a 1,500-mile network of pipe lines for distribution of the refined products, a power plant dismantled and shipped from Hamilton, Ont., pump stations and storage tanks.

The refinery will furnish aviation fuel for planes using the series of airfields between Edmonton and Fairbanks, Alaska; gasoline for trucks and Army equipment rolling over the long Alaska Highway, and diesel fuel for use in tractors and similar equipment.

Ownership of the pipe line will be retained by the United States until the end of the war, when it will be offered for sale, with the Canadian Government having the first right to purchase.

Sinclair's Butadiene Plant Is Now in Operation

HOUSTON. — Butadiene of the grade required for synthetic-rubber manufacture is now being produced at the Houston plant of Sinclair Rubber, Inc. Rated capacity is 50,000 short tons annually of butadiene, sufficient, when combined with the other ingredients of buna-S type of rubber, to make 60,000 long tons of synthetic rubber.

Butadiene produced is delivered to the adjoining government-owned copolymerization plant operated by Goodyear Synthetic Rubber Corp. as agent for the Rubber Reserve Co. Sinclair Rubber, Inc., is a wholly owned subsidiary of Sinclair Refining Co., operating under a lease agreement with Defense Plant Corp., owner of the plant.

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PIPE LINES

Texas-California Crude Line Plans Develop

Recent progress in preparations for meeting requirements of official approval for the proposed 936-mile 20-in. Texas-California crude-oil pipe line indicate that a decision may be reached soon. If this is favorable, it is reported that construction contracts may be let this year, possibly as soon as the next 90 days.

An application for permission was filed last week with the Petroleum Administration for War by officers of Pacific War Emergency Pipelines, Inc., which contemplates expending $47,000,000 for such a line from Monahans, Tex., to Beaumont, Calif., near Los Angeles, to move 200,000 bbl. daily. Officers of the company are Angus G. Wynne, president; J. C. Hawkins, vice president, and L. M. Glasco, secretary-treasurer, 408 Continental Bldg., Dallas, Tex.

Midwestern Engineering has been retained to prepare necessary documents for the company to submit to PAW in seeking approval of the project. This firm is prepared to handle engineering when approval is received.

In reaching a decision regarding the Texas-California project, it is reported that PAW will be influenced by the outcome of arrangements being discussed with the Navy for a greater utilization of the Elk Hills naval reserve in California.

Hollywood-Goleta, Calif., Line to Be Contracted Soon

Bids are to be received this month by Southern California Gas Co., according to reports, for the laying of 10 miles of 22-in. and 27 miles of 18-in. between Hollywood and Ventura, Calif. Bids will also be received by Southern Counties Gas Co. of California for 34 miles of 16-in. from Ventura to Goleta, Calif., near Santa Barbara. The two lines are to be part of the facilities being provided for increasing the effectiveness of underground gas storage measures of Pacific Lighting Corp., with which both of the companies are affiliated. The work is said to be scheduled to start in August. If the 26-in. line is built from the Hugoton field of Oklahoma and Kansas these lines, it is reported, will perform an important function in the program for handling peak winter loads by utilizing underground storage.

Pacific Lighting Plans Line From Hugoton, Okla.-Kans., Area

Preliminary plans are being made by Pacific Lighting Corp., Los Angeles, for the construction of a 26-in. pipe line from the Hugoton gas field of Oklahoma and Kansas to Riverside, Calif., where it will connect with systems of affiliated companies.

The line is expected to extend for a distance of 950 to 1,000 miles, following in a general direction the route of U. S. Highway 66 and the TWA airline route via Gallup, N. M., and Needles, Calif. Some surveying is reported to have been done already.

Arrangements for the purchase of gas are being discussed. Although it has been regarded as a postwar undertaking the demand for gas on the Pacific Coast may require starting the project within a year.

Construction in Progress for Kansas-Nebraska Gas Line

Work is being done on the project of Kansas-Nebraska Natural Gas Co. involving laying of 156 miles of 8-in., 12-in. and 18-in. Fredell Construction Co. has established a field office at Garden City, Kans., for its operations on the project.

Celanese Corp. Lays 90-Mile Gathering System in Texas

In connection with the plant being built for Celanese Corp. of America near Bishop, Tex., a 90-mile gathering system of 2-in. to 24-in. pipe is being laid by Gasoline Plant Construction Corp. which has contracted the entire project. Pipe is being coated with Perrault Brothers stationary equipment located near the railroad.

Northern Natural Builds New Station at Beaver, Okla.

Part of the materials are on the ground for building a new compressor station which Northern Natural Gas Co. has contracted with Midwestern

CRC

PIPE LINE CONSTRUCTION EQUIPMENT

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17 Plants to Serve the Nation

Engineering to erect near Beaver, Okla. It will have four 1,300-hp. compressors. The contractor has moved in and will start work this week.

Midwestern Engineering has started operations for laying pipe at crossings of the Big Sandy and Big Kanawha rivers in West Virginia for Tennessee Gas & Transmission Co. Earl Munson, superintendent for the contractor, has a field office at Huntington, W. Va.

Linehan Is Vice President of Mid-Continent Pipe Line

At a recent election of officers J. Marston Linehan, general manager of Mid-Continent Pipe Line Co., was chosen vice president. Jacob France heads the company as president.

Four Bridges to Be Built For Tennessee Gas Line

Tennessee Gas & Transmission Co. has arranged with Pittsburgh-Des Moines Steel Co. for the construction of bridges at the following river crossings: Red River, Natchitoches, La.; Sabine River, Hemphill, Tex.; Colorado River; Brazos River, Egypt, Tex. With the exception of two river crossings being laid by Midwestern Engineering in West Virginia the remainder of the major river crossings of the Tennessee line amounting to 15 altogether are being laid by Williams Brothers Corp. which is handling construction of crossings and laying of 600 miles of line for the system from offices at Monroe, La.

Phillips Plans $20,000,000 Hugoton Field Outlet

A 24-in. or 26-in. pipe line from the Hugoton and Panhandle gas fields to Wichita and Kansas City may be built by the Phillips Petroleum Co. at a cost of about $20,000,000, P. McDonald Biddison of Chicago and R. J. Wallace of Dallas, engineers for the firm, disclosed last week.

The engineers said sufficient customers had been listed in Wichita to warrant construction of the line that far, and a survey for potential industrial gas consumers is being conducted in the Kansas City area.

Haynesville Unit to Lay 150 Miles of Pipe

For lines to serve unitized operations in the Haynesville field, Louisiana, pipe has been ordered for approximately 150 miles of sizes from 2-in. to 20-in. Deliveries have begun and the laying of the pipe is to be contracted soon.

Arrangements for unitizing were recently completed for handling operations by an organization known as Haynesville Operators Committee for which J. R. Butler is manager. He is also manager of Cotton Valley Operators Committee. The Haynesville organization is to be separate from the one at Cotton Valley. Design and construction of the plant is being handled by Jones & Laughlin Supply Co.

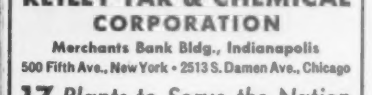
150-Mile Gas Line Approved for New York-Pennsylvania Area

Construction of a new pipe line to provide northern Pennsylvania and western New York with additional natural gas has been authorized by the Federal Power Commission.

FPC said two subsidiaries of the Consolidated Natural Gas Co., the Hope Natural Gas Co., and the New York State Natural Gas Corp., had been issued certificates for the facilities, which it is estimated will cost $3,473,863.

The line will consist of 150 miles of 12-in. with 9/32-in. wall thickness. It will extend from Wetzel, W. Va., to Clarion County, Pennsylvania, and will be built by four spreads. The Pennsylvania section is to be built by Hope and the New York section by the New York State company.

DRESSER STYLE 40 LONG SLEEVES



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DETROIT, MICHIGAN
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Exploration and Drilling

Week's Highlights

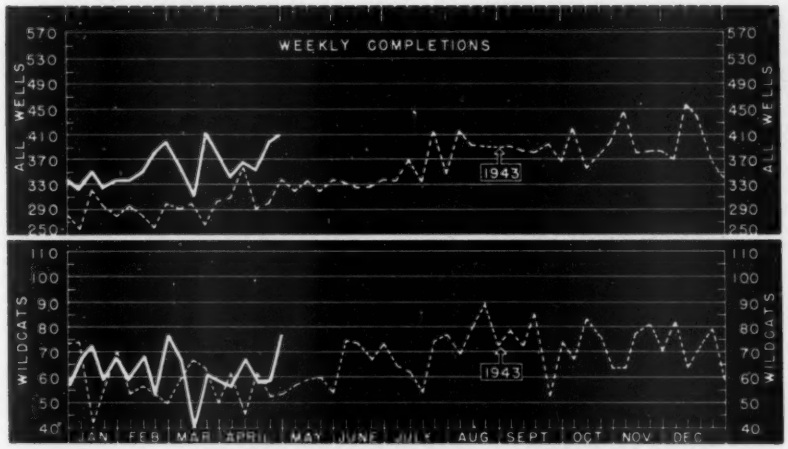
THERE are three distinct exploration plays now going on in new territory east of the Mississippi River. The first and by far the most important is the Mississippi-Alabama-Georgia-Florida play; the second is the increased activity in Tennessee, and the third is a more or less spotty activity here and there along the Atlantic seaboard from New Jersey to the Carolinas.

The Gulf Coastal Plain play, from Mississippi to Florida is a logical development of the discoveries in both states. It offers geophysics a comparatively virgin territory in which to bring to bear all the developments and refinements in instrumentation and interpretation of recent years. Since the geophysicists have found no startling discoveries among the war inventions, the next best thing is a new territory in which to apply their old science.

Reworking the older areas of the Mid-Continent at the present price of oil and the deep drilling required in most instances, is not the most economic way of using the all too few geophysical parties still available. The same amount of money and manpower, applied to virgin territory, should and probably will bring more discoveries and quite possibly, better discoveries with larger reserves.

With thick sedimentary basins, interrupted by major regional geological structures, around which production has been found in the Wilcox of Eocene age, the Selma, Eutaw, upper Tuscaloosa, lower Tuscaloosa, Paluxy and Glen Rose of the Cretaceous age, as well as unknown potentialities of numerous known salt domes, the geophysicists and geologists have a field of action, which combined with the demand for new oil, furnishes a combination that has not existed since the early twenties.

The Tennessee play is simply an extension of the south end of the old Appalachian area, and has attracted very little attention, although it has been gradually growing at a rate not seen for many years. The spotty activity along the Atlantic seaboard seems to be more or less a matter of increased consciousness about oil among the people of that territory, as a result of the war, plus the effect of the Florida discovery.



Solid line charts current weekly completions

COMPLETIONS IN ALL FIELDS . . .

Week Ended April 29, 1944

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1944	1943
N. Y., Penna., W. Va.	31	20	6	57	112,004	1,058	1,020
Ohio	1	7	7	15	51,338	295	243
Indiana	4	0	5	9	19,024	76	80
Kentucky	5	4	3	12	26,219	201	106
Illinois	18	0	11	29	84,340	509	584
Michigan	5	0	10	15	26,745	171	140
Kansas	9	2	15	26	86,723	552	452
Nebraska	0	0	0	0	0	8	7
Missouri-Iowa	0	0	1	1	2,122	5	4
Oklahoma	19	4	14	37	148,747	493	367
Texas:							
North Central Texas	20	0	24	44	85,934	464	385
West Texas	29	0	8	37	175,414	485	277
Texas Panhandle	7	0	1	8	25,048	53	58
Eastern Texas	0	0	1	1	11,510	98	81
Texas Gulf Coast	17	3	6	26	168,514	256	119
Southwest Texas	5	2	6	13	60,475	247	282
Total Texas	78	5	46	129	526,895	1,603	1,202
Louisiana:							
North Louisiana	1	3	0	4	18,336	84	94
Louisiana Gulf	6	0	5	11	111,469	136	102
Total Louisiana	7	3	5	15	129,805	220	196
Arkansas	0	0	3	3	11,442	67	71
Mississippi and Southeast	1	0	2	3	11,397	46	25
Montana	6	0	1	7	19,885	75	55
Wyoming	1	0	0	1	4,585	45	39
Colorado-Utah	0	0	0	0	0	10	5
New Mexico	4	1	2	7	27,582	125	67
California	34	1	9	44	165,890	617	374
Total United States	223	47	140	410	1,454,743	6,176	5,037
Total previous week	238	58	107	403			
Week ending May 1, 1943	188	33	115	336			

ILLINOIS

Degonia Sand Yields 500-Bbl. Well in Phillipstown Area

CENTRALIA.—The Degonia sand (upper Mississippi) in the Phillipstown Consolidated pool in White County this week yielded a 550-bbl. pumper, without having been shot. This pool is one of two in the state that produce from this formation, the other being the Epworth pool, also in White County. Sun Oil Co. 2 Renshaw, NW SW SW 18-4s-14w, got Degonia sand at 2,010-31 ft., and on the swab produced at the rate of 700 bbl. a day. On the pump it tanked 553 bbl. the first 24 hours.

Pure Oil Co. continued to get good wells in its Wayne County operations. Pure 4 B. F. Thomas, NE NE SW 11-1s-8e, Mount Erie pool, pumped 360 bbl. in 18 hours and then 341 bbl. in 24 hours from McClosky lime at 3,114-27 ft., after an acid treatment. In the south end of the Clay City Consolidated field Pure 1 J. A. Robertson, NW NW NE 3-1n-7e, after a shot in Aux Vases sand at 2,971-92 ft., swabbed and flowed 284 bbl. in 18 hours and then pumped 499 bbl. in 24 hours. Pure 1 Ollie Bolin, C NW SE 15-1n-8e, Clay City field, was acidized in McClosky lime at 3,063-83 ft. and pumped 490 bbl. of oil and 94 bbl. of water in 24 hours.

Five wildcat tests, all of them dry, were completed in the state during the week. Twenty-nine wells were completed of which 18 were oil wells and 11 dry.

Forty-three new operations were started including seven wildcats, Smokey Oil 1 Winters, NE NW SE 30-3n-11e, Richland County; Bell Brothers 1 C. R. Bowlds, SW SW NE 14-1s-8e, Wayne County; B. M. Heath 1 Wilkes, NW NW NW 8-6n-8e, Jasper County; T. W. Young 4 McCurdy, 430 ft. north and 320 ft from east line, SW SW 29-3s-6w, St. Clair County; A. Scherman 1 Zimmerman, NW NE SE 34-3n-4w, Clinton County.

ILLINOIS WILDCAT COMPLETIONS

Edwards County: Bennett Bros. et al 1 Henze, NW NW SW 12-2s-14w, dry at 2,935 ft., Cypress sand 2,629 ft., Benoist 2,712 ft., Aux Vases 2,839 ft.

Jasper County: Big Chief Drilling 1 Charles Ross, C NW NW 35-7n-9e, dry at 3,086 ft., base of Pennsylvanian 2,202 ft., Cypress 2,610 ft., Benoist 2,796 ft., Aux Vases 2,854 ft., McClosky 2,936 ft., St. Louis 3,076 ft.

Pike County: Herndon Drilling 1 B. A. Campbell, NE NW NW 15-4s-5w, fourth principal meridian, dry in granite at 3,206 ft.

Wayne County: Magnolia 1 R. C. Shannon, NE NW NW 8-1n-5e, dry at 3,153 ft., Menard 2,210 ft., Cypress 2,670 ft., Aux Vases 2,906 ft., McClosky 3,078 ft., St. Louis 3,136 ft.

Winkler & Powers 1 Garrison, NE NW NW 18-3s-7e, dry at 3,490 ft., Menard 2,506 ft., Cypress 3,060 ft., Benoist 3,180 ft., no Aux Vases, Ste. Genevieve 3,320 ft., St. Louis 3,478 ft.

EASTERN TEXAS

Dual Completion Made for Panola County Extension

DALLAS.—W. C. Feazel and Norman Kinsey 1 Ross, in the A. Moorman Survey, west extension to the Carthage gas-distillate field in Panola County was being completed from both the lower Pettit and Travis Peak sands as a distillate well, extending the Travis Peak producing area several miles. Recent gas-distillate completions have stirred interest in Panola, making it one of the most active leasing areas in the district. Unitization of acreage 4 miles south and east of Carthage by McAlester Fuel Co. and Grady Vaughn has been completed, and a Travis Peak lime test will be drilled soon in the Wyatt Anderson Survey.

Shelby County.—South of the Joaquin area, producing gas-distillate from the Rodessa series, Union Producing Co. is reported to be negotiating for a lease on lands owned by Pickering Lumber Co., and several wells testing the Pettit and Rodessa zones are in prospect. This area lies several miles southeast of the Carthage area.

Franklin County.—Abandonment was ordered for Humble Oil & Refining 1 Hogue, in the Humphries Survey, at 11,510 ft., after perforations up the hole failed to offer any encouragement.

Cherokee County.—In the Larissa area, Humble 1 Stephens was drilling below 8,826 ft. in lime and shale.

Houston County.—Another slim hole exploratory test was staked by Continental Oil Co. at 1 Fred Crowley estate, Ignacio Lopez Survey.

Navarro County.—North of Powell, on the Woodbine fault zone, J. W. Hooser and J. H. Burke are to drill 1 S. E. Johnson in the Joel P. Harden Survey.

EAST TEXAS WILDCAT COMPLETIONS

Franklin County: Humble Oil & Ref. 1 J. F. Hogue, Humphries Sur., on Titus County line, Pecan Gap 2,000 ft., Eagleford 3,280 ft., Woodbine 3,677 ft., Paluxy 5,221 ft., Travis Peak 7,303 ft., Cotton Valley 8,730 ft., Smackover 11,239 ft., dry at 11,510 ft.

SOUTHWEST TEXAS

McMullen County Test Gets Gas-Distillate Showings

CORPUS CHRISTI.—Edwin M. Jones 2-C Ezzell, wildcat Wilcox test, 4 miles southeast of Ezzell field, McMullen County, is getting gas-distillate showings in the Carrizo section and coring ahead below 6,901 ft. The latest drill-stem test at 6,892-6,901 ft. with 7/8-in. choke at bottom and 1/4-in. at top, showed 60 ft. of clear distillate and 20 ft. of distillate-cut mud, still rising when the tool was closed with 3,100 lb. pressure, flowing.

About 5 miles northeast of Thomaston, De Witt County, Shell Oil Co., Inc., is drilling ahead around 3,000 ft. in its 1 Alma Blackwell, wildcat which may be taken to 10,000 ft. Southeast of Yorktown in the same county, Butcher-Arthur 1 Kolodziejczyk was drilling ahead below 7,615 ft. in shale.

Great Lakes Carbon Corp.'s 1-A Yturria Land & Livestock Co., discovery gasser about 5 miles southwest of Port Isabel, has been shut in after completing in sand at 5,980 ft. Under tubing pressure of 1,600 lb. it flowed an estimated 6,000,000 cu. ft. of gas daily with a spray of distillate.

In Bee County, the name "Yougeen" has been given to the field opened by W. Earl Rowe 1 Peters, southwest of Beeville. It showed 158,000,000 cu. ft. of gas daily on open-flow potential test from pay topped at 3,794 ft. Casing was perforated at 3,796-3,806 ft. for completion.

Northeast of Burnell-Wilcox production about 1½ miles, Stanolind Oil & Gas Co. 1 Spielhagen, in Karnes County, was shut in after completing at 6,750-90 ft. for a calculated open-flow potential of 36,500,000 cu. ft. of gas daily.

New wildcat tests in the Southwest Texas district include one by M. M. Miller, just east of the Longhorn field, where he will drill 1 Leroy Denman on an 80-acre lease in the Santos Garcia Survey.

About 2 miles northwest of Mission Valley in the western corner of Victoria County, Northern Ordnance Co. has staked location for 1 W. W. Schaefer, 1¼ miles southwest of its 1 Heath, in the W. J. Eaton Survey.

Siosi Petroleum Co. is scheduled to drill a wildcat in San Patricio County near Gregory in Section 41, fourth addition to Taft Farm Lots.

SOUTH AND SOUTHWEST TEXAS WILDCAT COMPLETIONS

Duval County: M. E. Davis 1 Atlee Parr, 4 mi. E of Sweden field, dry at 5,616 ft.

J. W. Gorman 1-A W. K. Hoffman, BS&F Survey 113, dry at 3,375 ft.

J. W. Gorman 1-B W. K. Hoffman, 7½ mi. SE of Freer, dry at 3,366 ft.

DAILY AVERAGE PRODUCTION FOR WEEK

	Apr. 29 crude oil	Distillate, allied products	April PAW quota all oils	Apr. 22 crude oil
Arkansas	79,500	5,000	81,700	79,500
California	827,250	47,000	876,300	833,750
Colorado	7,850	.....	7,000	7,750
Eastern	72,500	8,600	81,000	72,400
Illinois	205,800	13,000	228,000	201,900
Indiana	13,900	.....	13,600	14,200
Kansas	273,600	5,800	290,800	263,800
Kentucky	24,400	2,700	25,700	22,300
Louisiana	358,050	34,000	381,700	358,550
North Louisiana	75,300	.....	.....	76,050
Louisiana Gulf	282,750	.....	.....	282,500
Michigan	52,100	300	53,300	48,500
Mississippi	42,900	.....	45,000	42,750
Montana	21,450	300	24,300	21,900
Nebraska	1,100	.....	1,000	1,200
New Mexico	112,000	4,900	116,600	111,850
Oklahoma	333,850	28,000	356,000	335,550
Texas	1,910,450	127,000	2,043,000	1,910,350
East Texas	362,250	.....	.....	362,300
West Texas	374,100	.....	.....	374,000
North Central Texas	143,850	.....	.....	143,850
East Central Texas	127,250	.....	.....	127,200
Texas Panhandle	91,150	.....	.....	91,200
Texas Gulf	716,850	.....	.....	716,800
Southwest Texas	95,000	.....	.....	95,000
Wyoming	99,300	6,900	99,900	99,150
Total United States	4,436,000	283,500	4,725,000	4,425,400

Total production January 1-April 29, 1944 ..... 528,198,961 bbl.
Same period last year ..... 463,060,085 bbl.

Magnolia 1 Duval Co. Ranch Co., 3 mi. S of Casa Blanca field, dry at 4,060 ft.
H. J. Porter 1 W. W. McCampbell, 2 mi. W of FitzSimmons field, dry at 4,003 ft.
Jim Wells County: H. F. Wilcox Oil & Gas Co. 1-B W. F. Almond, HT&B Sur. 7, dry at 5,421 ft.
Nueces County: Hewitt & Dougherty 1 Selma M. Mumme, Bluntzer area, shut-in gas well, no gage, TD 6,252 ft.

LOUISIANA GULF

New Field Opener Finished By Sun in Cankton Area

NEW ORLEANS. — Interesting developments along the Louisiana coast include final completion of a new oil field opener, possibility of establishing a new record producing depth, and staking of locations for important wildcat and extension tests.

In the DeLarge area of Terrebonne Parish, Union Production Co. and Fohs 2 Buckley Bourge is preparing to make production tests near total depth of 13,588 ft., following squeeze jobs. The liner was perforated at 13,550-55 ft. for a drill-stem test, using ¼-in. chokes. After flowing water cushion in 32 minutes the well built up a pressure of 1,400 lb. in an hour and flowed an estimated 25 bbl. of fluid hourly, about 60 per cent oil and 40 per cent salt water. Owing to difficulty in getting the liner properly set, operators do not know whether the water is coming from the formation being tested. The next test should tell. The same operators last year completed a well in this area at 13,475-490 ft., as the world's deepest production.

Sun Oil Co. is preparing to move in rig to 1 Laurent Patin, about 1,200 ft. south of the discovery well, 1-B E. M. Boagni, in the Cankton area, Acadia Parish, now officially completed. The new test is to be in 48-8s-4e. The discovery itself completed a potential test during the past week, flowing 470 bbl. of 38° oil daily through a 9/64-in. choke, with tubing pressure 1,750 lb. and casing sealed.

Humble Oil & Refining Co. is scheduled to drill a new 9,500-ft. wildcat on the Ponchatoula prospect in Tangipahoa Parish. This test, 1 Williams, Inc., is to be in 31-7s-8e, about 1½ miles southwest of 1 Rathborne Land Co., 9,314-ft. dry hole drilled by the company earlier this year on the same prospect.

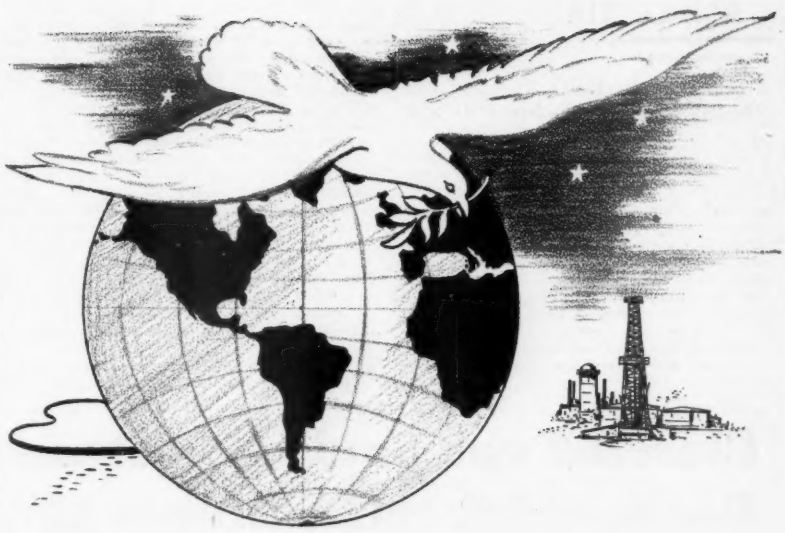
Magnolia Petroleum Co. is preparing to drill a long northeast outpost to the West Gueydan field in Vermilion Parish. It will be 1 Fisher estate, in the west half of 39-12s-2w, 1½ miles from the nearest production. Magnolia is now drilling 1-D Reese on the southeast flank of this dome.

Sun Oil Co. spudded its 1 Freeland, over 1½ miles northeast of production in the Egan field, Acadia Parish, and was drilling below 1,973 ft. of surface casing at lastest report.

New tests are scheduled for the North Richie field, Acadia Parish, where Continental Oil Co. will drill 1 Fusilier north of production, and for the Rosedale field, in Iberville Parish, where Southwestern Oil & Refining Co. is preparing to drill 1 Angelloz in 42-7s-10e.

LOUISIANA GULF COAST WILDCAT COMPLETIONS

Iberville Parish: Humble Oil & Refining Co. 1 Federal, 1-11s-13e, dry at 11,738 ft.
Vermilion Parish: The Texas Co. 1-D State, Vermilion Bay-T-15s-4e, dry at 11,649 ft.
St. Landry Parish: Sun Oil Co. 1-B E. M. Boagni, 48-8s-4e, 470 bbl. through 9/64-in. choke, TP 1,750 lb., perf. 9,667-90 ft. Completed 4-17-44. Cankton field discovery.
St. Mary Parish: The Texas Co. 1-State, Point Marone area, dry at 11,516 ft.



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CALIFORNIA

Buena Vista Hills to See Exploratory Activity

LOS ANGELES.—The next 30 days should reveal important facts regarding the recently discovered basal Pliocene zone in the Buena Vista Hills field. New work is getting under way and locations have been staked in areas removed fom the discovery well. Some field men predict there soon will be not less than 50 strings of tools in operation on the United anticline, which is a part of the field. Standard Oil Co. of California, which has extensive holdings, will head the list. The oil tests 31-gravity, is sweet and the productive zone is relatively shallow.

Wildcat mortality in California continues high and there have been no recent indications of a major discovery. At Bellevue, Superior Oil Co. appears to have the makings of a well in the Miocene, but the sand thickness is limited in the upper Stevens. In the Cymric area north of the old McKittrick filed in Kern County, Superior completed an outpost pumping 119 bbl. daily. West of the Aliso Canyon field Barnsdall is preparing to resume drilling operations in 1 Roosa, which found small shallow production on the beam, and will carry the hole down to the Sesnon zone of Miocene age. Edwin and Harold Pauley's 1 Loftus, a recent wildcat bottomed beneath the Hyperion sewer farm at El Segundo, has been taken off the pump for a cleanout job and to reperforate.

In Los Angeles Basin drilling operations continue active in the Huntington Beach and Wilmington fields. In the latter, operators now are permitted to proceed with development work according to the amount of undeveloped acreage. This is due to a revision in well density and recalls the statement of operators over a year ago that this field could not be developed satisfactorily unless the multiple zone factor was considered. As a result of increasing well density, the field is producing approximately 100,000 bbl. daily.

At Huntington Beach operators still are engaged in developing the Jones sand of Pliocene age, which is still in a flush condition. Highest production is obtained from wells whipstocked out beneath the tidelands, although no well is permitted to produce except through a small bean. Many of these Jones sand wells take in about 1,000 ft. of formation and 32 have been finished to date.

CALIFORNIA WILDCAT COMPLETIONS

Cat Canyon wildcat district, Santa Barbara County: Union 1 McNee, 20-9n-32w, dry at TD 3,663 ft.

Edison wildcat district, Kern County: Wilshire 1 Cardoza, 8-30s-29e, dry at TD 4,694 ft.

Richgrove wildcat district, Tulare County: Lomi Oil Corp. 1 Burnell, 30-24s-27e, dry at TD 2,510 ft.

Rio Bravo wildcat district, Kern County: Union 88-8 Kernco, 8-29s-25e, dry at TD 10,844 ft.

Round Mountain wildcat district, Kern County: Iseminger Brothers 2 Recovery, 2-28s-28e, dry at TD 1,950 ft.

Trico wildcat district, Kern County: H. H. Magee 1 Amalgamated Happold, 15-25s-24e, dry at TD 3,051 ft.

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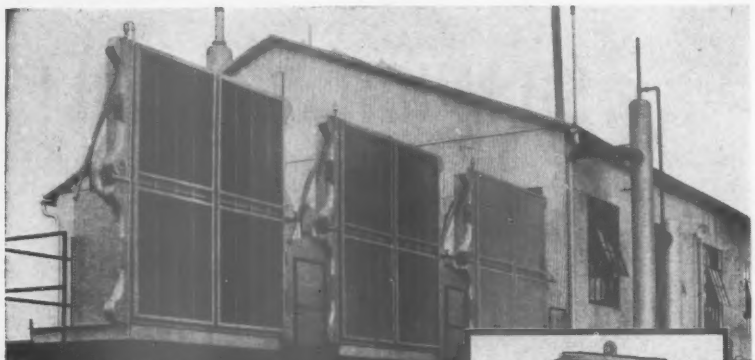

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*Stated in Diesel Power, February 1944 — "Diesel Engine Insurance."

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TEXAS GULF COAST

Shut-in Order for Bammel Field Suspended 30 Days

HOUSTON.—Although field-pressure studies are still under way in the Bammel field, Harris County, the State Railroad Commission suspended for 30 days its order requiring that the field be shut in entirely on May 1. Recent surveys had indicated a pressure drop of around 200 lb. over a period of several months while the Corzelius well was blowing wild through the crater. The commission's order still requires that pressure tests be made at intervals of 3 days to determine extent and nature of changes.

Final completion of Sun Oil Co. 1 Daugherty pool, as discovery well for the North Winnie area, Chambers County, has been accomplished. Perforations were made at 8,757-59 ft., following a squeeze job, and on early tests the well was flowing at the rate of 50 bbl. of 37.6-gravity oil in 4 hours through a 10/64-in. choke, with tubing pressure 2,050 lb. and gas-oil ratio 2,235-1. Previous tests made when casing inadvertently had been perforated too high in the section showed a little condensate and lots of gas under high pressures. Preliminary information on the area indicates that conditions are such that development will probably be on a dual-completion basis, and development may be rapid.

Also in Chambers County, Sun has made location for an outpost in the Jackson Pastures area, in the southern part of the county. The new test, 1 J. E. Jackson, about ½ mile southwest of the Crosby-Mayo discovery well, is scheduled to go to 8,425 ft. for a test of the regular sand.

Gulf Oil Corp. and Humble Oil & Refining Co. are scheduled to start immediately their deep test in the Thompson field of Fort Bend County. Their No. 8 Scanlan on the east side of the field may be drilled to 11,000 ft.

In southern Jefferson County, Shell Oil Co. has made location for a new wildcat to test formations to a depth of 8,750 ft. The 1-E McFaddin Trust will be in the area

where the same operators recently abandoned 1-D McFaddin.

Sun's B-2 Braman, which extends the North Bay City field to the west, is apparently opening a new sand several hundred feet deeper than the regular pay. Perforations were made at 8,400-02 ft. and the well was flowing 124 bbl. daily through a ⅛-in. choke with gas-oil ratio 578-1. The field regularly produces from above 7,900

TEXAS GULF COAST WILDCAT COMPLETION

Brazos County: Phillips Petroleum Co. 1 Wharton Weems, Millican area, J. M. Barrera Survey, completed 4-2-44, 5,500,000 cu. ft. gas through open 2-in. tubing, shut in, no market, TP 1,220 lb. flowing, 1,290 lb. shut in, TD 4,998 ft..

N. CENTRAL TEXAS

Conglomerate Pool Opened In Montague County

WICHITA FALLS.—Continental Oil Co. 1 Hundley, in the Martindale Survey, southwest of Mallard, assured a new field from the Bend conglomerate when it took a 90-minute drill-stem test at 6,231-61 ft., showing gas in 3 minutes and flowing oil in 5 minutes, recovering 920 ft. of oil and 160 ft. of water in the drill pipe. Operator was drilling to the Ellenburger formation and if that proves unproductive will plug back to complete in the conglomerate pay. This well, on acreage owned jointly by Continental and Sinclair Prairie Oil Co., is about 1¾ miles north of Sinclair Prairie 1 Templeton, which has opened another field from the conglomerate pay. Casing and tubing have been run in the Sinclair well, but results of tests have not been announced.

Cooke County.—Magnolia Petroleum Co. 1 Sallie Long, Horse Shoe Bend area, topped the Ellenburger at 5,817 ft., showing only a rainbow of oil on drill-stem test and was drilling ahead. This well is north offset to Sinclair Prairie 1 Winnie Montgomery, which opened the area from the Strawn sand at 5,112-30 ft. A northwest offset to the discovery, Sinclair Prairie 1 Cory, is being drilled "tight." It is below the pay zone of the discovery.

Young County.—L. T. Burns 1 Marie L. Christian, 1½ miles northeast of True, a failure in the Bend zones, plugged back to test sand showing at 2,584-92 ft., and swabbed an estimated 100 bbl. per day through perforations.

Montague County.—Two good wells were completed in the Hildreth field, the most important discovered in North Texas in the past year. S. & D. Daube 1 J. D. Prestwood, ETRR Survey, flowed 84.23 bbl. in 3 hours through ½-in. choke, and O. C. Whitaker 1 Boedecker, Section 55, flowed 286.63 bbl. in 6 hours through ½-in. choke.

Wichita County.—Panhandle Refining Co. 1 E. B. Madden, 5 miles west of Wichita Falls, was preparing to run drill-stem test in Caddo lime and conglomerate encountered at 5,133-78 ft.

NORTH TEXAS WILDCAT COMPLETIONS

Archer County: S. F. Hutcheson 1 Joe McDonald, Jose Ostane Sur., dry at 1,495 ft.

Denton County: Hunt Oil 1 M. L. Martin, J. Parks Sur., dry at 2,979 ft.

Grayson County: Sinclair Prairie 1 Geo. A. Fischer, J. Shelton Sur., dry at 6,313 ft.

Montague County: Sloan & Zook 1 H. H. Durham, Francisco Escobar Sur., dry at 4,393 ft.

Wichita County: Hanlon-Buchanan 1 N. R. Temple, 5 mi. SW Iowa Park, dry at 4,542 ft.

Frank Wood 1 G. R. Campbell, Blk. 4, Crawford Pasture subd., dry at 1,401 ft.

Wilbarger County: Texas 1 C. Matysek, H&TC Ry. Sur., 60 bbl. pay 2,794 ft., TD 2,840 ft., extension Main pool.

Humble 1 Haseloff, H&TC Ry. Sur., dry at 4,863 ft.

Young County: Thos. D. Humphrey 1 M. K. Graham estate, G. W. Robinson Sur., 920 bbl., pay 3,995 ft., TD 4,160 ft. Discovery.

Kerlyn Oil 1 W. W. Cope, TE&L Sur., 614.52 bbl., pay 4,385 ft., TD 4,436 ft.

WEST CENTRAL TEXAS

ABILENE.—Two new producers are in prospect for the area south of Novice, northwest Coleman County. Hunter & Hunter 1-C C. C. Williams, T&NO Ry. Survey, south offset to the recent completion, 1-B Williams, had cemented casing at 3,760 ft. on top of the Gray sand, preparatory to completion. West offset to the discovery, Hunter & Hunter 1 Birdwell, had cored Gray sand to 3,820 ft., with sufficient showing to assure production. W. W. Harvey has taken over the well of L. H. Wentz, 1 McCord, 3 miles northwest of Glen Cove, and will drill deeper from total depth of 3,757 ft. in search of Gray sand production. This wildcat was abandoned in January after missing the pay, and subsequent correlations indicate that the Gray sand was not reached. Only a small show was recorded in the Morris pay, but favorable structural position was determined.

WEST CENTRAL TEXAS WILDCAT COMPLETIONS

Jones County: Wm. D. Brookover 1 E. L. Kelso, Lot 101, Lge. 126, De Witt County School Land, dry at 2,845 ft.

Taylor County: W. H. Rogers, trustee, 1 A. L. Cade, T&P Ry. Sur., dry at 2,655 ft.

Throckmorton County: Grisham Hunter Corp. 1 R. W. Kelly estate, Brooks & Burleson Sur., dry at 925 ft.

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PERMIAN BASIN

Kimble County Test Looks Like Important Strike

MIDLAND. — Phillips Pet. 1 Spiller, in Choice Survey, near the Menard County line, indicated an important strike from the Ellenburger lime by flowing a barrel a minute on a 15-minute test. The flow was made after treatment with 500 gal. of acid. Casing was cemented at 2,373 ft., and total depth of the well is 2,405 ft. This test is on the Edwards plateau, where shows have been encountered in many of the wells drilled, and some put on production, but where exploration on the whole has been disappointing.

Ownership of the land is in tracts of several thousand acres, making blocking comparatively easy. Showing thus far in the Phillips wildcat has assured an active lease play for the general area. About 12 miles northwest of the new strike, in Menard County, B. A. Duffy 1 Sol Mayer is a new wildcat project, 3 miles northeast of Fort McKavitt.

Coke County.—Prospects of opening another field from Ellenburger formation were somewhat brighter at Warren Petroleum Corp. 1 Fowler, in the Blackwell area, which acidized after plugging back and drilling out to 6,412 ft. This well, originally drilled to 6,425 ft., showing oil and water, swabbed 4 bbl. an hour with only ½ of 1 per cent basic sediment and water after the plugback and acid. Should it prove commercial, it will open a big area for Ellenburger exploration.

Andrews County. — The Fullerton pool apparently was being widened to the west by 1 mile at Anderson-Prichard Oil 1 McCrea, which, at total depth of 6,900 ft., showed good prospects.

Howard County.—Third pay for the Vincent pool was proved at W. C. Guthrie and Cosden Petroleum Corp. 2 Pauline Allen, Lavaca Navigation Survey, which was completed for an initial potential of 36.37 bbl. of 37.6° oil.

Gaines County.—First dual completion for the Wasson pool is Amon G. Carter 5-C Wasson, NE SW Section 49, Public School Land, which made 469 bbl. of 33° oil from the upper Clear Fork pay at 6,300-6,876 ft., and 225 bbl. of 35° oil from the lower Clear Fork pay at 7,090-7,426 ft. The upper zone was acidized with 8,000 gal. and the lower with 5,000 gal.

WEST TEXAS WILDCAT COMPLETIONS

Concho County: E. M. Thomasson 1 C. T. Keys, ACH&B Sur., dry at 2,922 ft.

Crockett County: John I. Moore 1 J. S. Todd estate, EL&RR Sur., dry at 2,502 ft.

Gaines County: Case-Pomeroy & Co. 1 fee, Sec. 13, Blk. C-44, Public School Land, dry at 2,320 ft.

Sid W. Richardson 1 R. A. Cox et al, WTRR Sur., dry at 5,800 ft.

Howard County: W. S. Guthrie & Cosden 2 Pauline Allen, Lavaca Navigation Sur., pump 26.37 bbl., 37.6°, pay 5,450-5,500 ft., TD 6,172 ft., new pay in Vincent pool.

Pecos County: Gulf 1 R. E. Sanders, H&GN Ry. Sur., dry at 2,960 ft.

Yoakum County: Honolulu Oil 1-78 Williams, J. H. Gibson Sur., dry at 5,215 ft.

SOUTHEAST NEW MEXICO

HOBBS.—A small showing of oil was reported from the deep test of Barney Cockburn 1 Wyatt-State, on the northeast edge of the Maljamar pool, drilling at 5,964 ft. in lime. Some water was reported with the oil. The Ellenburger project of Humble Oil & Refining Co. 1 Federal-Leonard, 12-26s-37e, was drilling ahead in Silurian formation with no further shows reported after the encouragement offered a week earlier.

SOUTHEAST NEW MEXICO WILDCAT COMPLETIONS

DeBaca County.—M. Staniforth 1 State, 1,650 ft. from N, 330 ft. from E, Sec. 27-4n-22e, elev. 4,846 ft., dry at TD 1,785 ft.

Lea County: Carper Drlg Co. 1-X Nellis, 660 ft. from N, 1,980 ft. from W, Sec. 5-19s-33e, elev. 3,715 ft., dry at TD 4,305 ft.

R. Olsen Oil Co. and Atlantic Ref. 1 Langlie, 660 ft. from S & E, Sec. 11-25s-37e, elev. 3,133 ft., base San Andres 3,640 ft., base Permian 7,545 ft., Ellenburger 9,685 ft., SO 3,785 ft., 4,900 ft., 8,200-40 ft., IP 2,200,000 cu. ft. gas, PB 4,885 ft., TD 9,592 ft. Gas discovery. Langlie pool.

APPALACHIAN FIELDS

Smith Petroleum to Drill Clay District Wildcat

PITTSBURGH.—In Clay district, Hancock County, Smith Petroleum Co. has made a location for an Oriskany wildcat on the C. A. Smith farm, about 6 miles north of New Cumberland on State Route No. 2. There is one Oriskany gas well producing in that county.

In Raleigh County, Godfrey L. Cabot, Inc., had a small showing of gas (15,000 cu. ft.) in the Oriskany sand in the test on the C. E. Gwynn farm in Richmond district and will shoot the sand. Elevation

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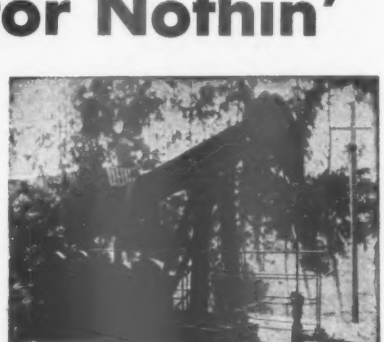

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1,294 ft., Corniferous lime corrected to 6,185 ft., Oriskany 6,314 ft., TD 6,390 ft.

In Jackson County, Hope Natural Gas Co. was unable to cement off water from the Newburg in 8585 B. M. Pfost, Washington district, and will run 5½-in. casing to 6,119 ft. with the Newburg at 6,072 ft. The test then will be deepened to the Clinton.

In Tucker County, Ohio Oil Co. reached 8,038 ft. in its Oriskany wildcat on the Kaemmerling tract in Dry Fork district and was forced to shut down with stuck drill pipe. This test is 60 ft. in the Oriskany sand, with no gas showing in the mud.

In Venango County, western Pennsylvanian, Hathaway Brothers completed an Oriskany wildcat on the Clyde VanCamp farm in Jackson Township, with salt water in the Oriskany sand. Elevation 1,592 ft., Oriskany 4,090 ft., TD 4,096 ft.

ROCKY MOUNTAIN

Deeper Areas of Big Horn Basin to Be Tested

DENVER.—Successful testing of the rim of the Big Horn Basin is encouraging geophysical work in the deep part of the basin, and it is reported that at least two major anticlinal folds have been mapped. An active leasing play has begun and several hundred thousand acres have been blocked.

Tensleep producer at Garland.—Ohio Oil Co. 6 Ohio-Kinney-Coastal unit swabbed 360 bbl. per day from 107-ft. saturation in the Tensleep at 4,485 ft., total depth, on the northwest flank of the Garland dome. It is ¼ mile north of No. 5 and 60 to 70 ft. lower on structure.

Good well at Gebo.—Continental Oil Co.'s second well on the Gebo dome, Hot Springs County, Wyoming, flowing 21 bbl. per hour natural from the Embar through 475 perforations at 4,534-4,650 ft. The second well promises to be much larger than the discovery and is now preparing to acidize.

Steamboat Butte discovery. — British-American Oil Producing Co. 2-C Tribal, Tensleep discovery at Steamboat Butte, which was completed last week, flowing 251 bbl. per day, made 570 bbl. on the pump.

Cooper Cove discovery.—Stanolind Oil & Gas Co. 1 Johnson-Parkinson, SE NE SW 20-18n-77w, Cooper Cove structure in Carbon County, in a drill-stem test in the Sundance at 5,280-5,304 ft., recovered 100 ft. of mud and 100 ft. of water. It is plugging back to complete in the Dakota, where a drill-stem test showed 3,500 ft. of oil in 75 minutes.

Sheldon dome test.—Kerlyn Oil Co. and Carter Oil Co. are moving in rotary rig for a joint test in the NE NE 16-5n-2w on the Sheldon dome, 5 miles southwest of the Maverick Springs field. The Dakotas, Sundance and Embar-Tensleep horizons will be tested.

Bell Rock showing gas.—The 8,000-ft. test on the Bell Rock structure, Moffat County, Colorado, 1 Hanawalt, NE SE SE 4-6n-92w, being drilled by Stanolind Oil & Gas Co. as a joint operation with Ohio Oil Co. and Continental Oil Co., had the Mesa Verde sand at 2,856 ft. A drill-stem test at 2,860-87 ft., open 1½ hours, flowed 156,000 cu. ft. of gas. The well is coring ahead at 2,989 ft.

Ute bids rejected.—Bids received by the Consolidated Ute Indian agency for lease on 1,280 acres of Indian owned land in Township 32n-13w, southwestern Colorado, on March 15 were not acceptable.

MONTANA WILDCAT COMPLETIONS

Rosebud County: Northern Ordnance 1 N.P. R.R., NW SE 27-9n-35e, dry at TD 5,907 ft., in top of Madison.

MICHIGAN

Sun Gets Two Producers In Missaukee County

SAGINAW.—Two wells drilled by Sun Oil Co. in Norwich Township, Missaukee County, developed into commercial producers last week. Each was doing 300 bbl. a day at depths around 4,600 ft. Leonard Drilling Co.'s Cranberry Lake test in Winterfield Township, Clare County, got only a trace of oil and drilling was halted at 5,200 ft.

Field activites last week yielded 15 completions, with 10 dry holes, 7 of which were wildcat tests. Gulf Refining Co. completed a good well in the Fork-Mecosta field, reporting 306 bbl. pinched from 2 Compson in Section 6. Pure Oil Co. 2 Stoner, in Goodwell-Newaygo, flowed 108 bbl. the first 12 hours and Ohio Oil Co. added a small producer in Lincoln-Osceola.

Drilling permits isued this year now total 164, the state Conservation Department granting 13 more for oil and gas exploration in nine counties. Gratiot and Mecosta locations accounted for six permits. The others were for Midland, Roscommon, Bay, Allegan, Kent, Iosco and Clinton.

MICHIGAN WILDCAT COMPLETIONS

Allegan County, Monterey Township: Muskegon Development Co. 1 Wilcox, SW SW NE 20-3n-13w, dry at TD 1,819 ft.

Overisel Township: J. E. Hood 1 Boeve, NW NE NW 6-4n-14w, dry at TD 1,712 ft.

Clinton County, Bath Township: William H. Colvin, Jr., 1 State, NW SE SE 14-5n-1w, dry at TD 2,893 ft.

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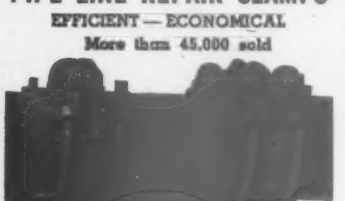

Fig. 7002 Fig. 7001

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William H. Colvin, Jr., 1 A. E. Homer, N½ SE NW Sec. 25, abandoned at TD 95 ft.

Genesee County, Forest Township: John F. Burton 1 Mulligan, NE NW SW 25-9n-8e, dry at TD 1,665 ft.

Kalamazoo County, Oshtemo Township: Fisher-McCall Oil & Gas, Inc., 1 L. H. Bishop, NW NW NW 5-2s-12w, dry at TD 1,392 ft.

Livingston County, Iosco Township: William H. Colvin, Jr., 1 Minnie Alexander, NE SE NE 4-2n-3e, dry at TD 68 ft.

OHIO, KENTUCKY

West Zanesville Gas Area Extended Northeasterly

ZANESVILLE.—The best gas well in the recent drilling in the West Zanesville area was completed by the H. K. Porter Co. on the L. K. Brown tract, 1 mile west of town, and is an extension to the northeast. Clinton sands at 3,463-90 ft. yielded an initial of 5,240,000 cu. ft. with a rock pressure of 1,120 lb. Other locations to the north and east will be drilled.

Pure Oil completed at 2,110,000 cu. ft. Clinton sand well on an inside location in Section 26, York Township, Morgan County.

The second well, 1 C. R. Cline, Section 2, Wayne Township, Monroe County, to reach the Warren horizon in the Woodsfield area found no sand, nor any shows of either oil or gas in the shale. The test was drilled deeper from the Berea sand by Belmont Quadrangle Co. to 3,164 ft. The discovery well, South Penn 1 George Kerr, now being deepened, is drilling in hard white Oriskany sand with no shows at 13 ft. in.

WESTERN KENTUCKY

OWENSBORO, Ky.—Eight wells were completed in Western Kentucky in the past week in Union, Edmondson, Webster and Daviess counties. No large producers were reported. Carter Oil Co. Matilda Hagen test, 1 mile from Hitesville in Union County was dry at 2,587 ft. Six of the eight completions were producers.

WESTERN KENTUCKY WILDCAT COMPLETIONS

Union County: Carter Oil 1 Matilda Hagen, 1 mi. E of Hitesville, dry at 2,587 ft., Vienna 1,824 ft., Barlow 2,205 ft., Ste. Genevieve 2,498 ft., McClosky 2,571-87 ft.

EASTERN KENTUCKY

ASHLAND.—Four gas wells were completed in the eastern Kentucky fields in the past week, with a combined daily open flow of 1,739,000 cu. ft. Four new locations were reported, and drilling operations point slightly upward.

Kentucky West Virginia Gas Co. completed four wells as follows: 737 J. A. Scott, on Johns Creek, in Pike County, at 2,685 ft. in brown lime, with a daily open flow of 989,000 cu. ft.; 5514 Charles Bartley, Shelby Creek, Pike County, 3,262 ft. in shale, 140,000 cu. ft. of gas; 5,522 G. W. Dabis, Daniels Creek, in Johnson County, 2,239 ft. in shale, 146,000 cu. ft. of gas; 5529 William Hamilton, Mud Creek, in Floyd County, 1,119 ft. in salt sand, 464,000 cu. ft. of gas.

INDIANA

EVANSVILLE, Ind.—Superior Oil completed two good wells on the Mabel Marvel Unit in 30-2s-11w, Gibson County. 1 Marvel produces from four pays, Cypress at 1,962-90 ft., Paint Creek at 2,078-92 ft., Benoist at 2,133-53 ft., and McClosky lime at 2,294-96 ft., total depth 2,338 ft. Initial production was 180 bbl. 2 Marvel started at 235 bbl. from McClosky lime at 2,289-91 ft., total depth 2,301 ft.

INDIANA WILDCAT COMPLETIONS

Jay County: Indiana Farm Bureau 1 Binegar, SE NE NW 29-24n-13e, dry at about 1,225 ft.

Posey County: Frontier Fuel Co. 1 William E. Hill, SE SE SW 18-7s-12w, dry at 2,776 ft.

CANADIAN FIELDS

Roxana to Test Theory of Continuous Structure

CHATHAM.—The theory that an almost continuous structure extends from Turner Valley on the south to a point beyond Marble Mountain, near Clearwater River, is to be tested by Roxana Petroleums, Calgary, which has acquired approximately 23,000 acres in Keystone Valley. The Roxana holdings extend along a strip 17 miles long and 2 to 3 miles wide, between Townships 20 and 27, Ranges 6 to 8w5. The first test will be drilled this summer near Salter Lake, about 6 miles due west of Imperial-Wildcat Hills 1, LSD 16, 30-27-5w5.

Drilling in Turner Valley has revealed two major faults limiting the producing area, the Turner Valley major fault to the east and the Outwest fault to the west, with the producing wells inside the intervening strip. Farther north, however, drilling has been outside the strip defined by the two faults, with most of it to the east.

Pekisko.—At Pekisko Hills 1, LSD 6, 6-17-2w5, F. D. Lundy and associates, of Calgary, are rigging to deepen from 4,400 ft. The well, drilled several years ago, is about 6 miles south and slightly west of the most southerly Turner Valley production.

Aldersyde.—About 13 miles east of Turner Valley, New Ranchmen's-Snider 1, LSD 16, 34-19-29w4, on the Aldersyde structure, is deepening for a thorough test of the

LEGAL

U. S. DEPARTMENT OF THE INTERIOR. General Land Office, District Land Office, Las Cruces, New Mexico. Notice is hereby given that the lands herein described within the known geologic structures of the Pecos Valley and Red Lake oil and gas fields, New Mexico, are offered to qualified bidders of the highest cash amounts offered per acre as a bonus for the privilege of leasing the land under section 17 of the leasing act, as amended by the act of August 21, 1935 (49 Stat. 675, 30 U.S.C. 226), at a sale to be held in the District Land Office at Las Cruces, New Mexico, at 10 a.m., on May 18, 1944, in the following parcels, all in T. 17 S., R. 28 E.: Pecos Valley Field, Parcel No. 1, lots 1, 2, 3, 4, S½ N½, E½ SE¼ Sec. 3, E½NE¼ Sec. 10. Parcel No. 2, W½W½ Sec. 5 Red Lake Field. Parcel No. 3, SW¼SW¼ Sec. 10. Parcel No. 4, NE¼ Sec. 15. Each successfu bidder must deposit on the date of sale with the officer in charge of the sale a certified check or cash for one-fifth of the amount bid by him, and file the showing of qualifications to receive a lease, required by section 7 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of one dollar per acre must be paid and a $5,000 corporate surety bond must be furnished prior to the issuance of the lease. Each parcel will be offered for sale separately, but the successful bidder of the two parcels in either field may consolidate the two parcels in a single lease and may file a collective bond. Bids may be submitted by mail provided they are accompanied by one-fifth of the bonus bid and a showing of qualifications of the bidder. The envelope should be plainly marked for opening on the day and hour of the sale. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Paul A. Roach, Register.

Madison, after cementing off perforations in the top of the lime when a small water intrusion developed. Small quantities of crude encountered tested 38.6°, slightly heavier than Turner Valley crude.

Lloydminster.—In the Lloydminster field, eastern Alberta, Shaw-Alberta 3, LSD 5, 35-49-1w4, bottoming at 1,908 ft., while pulling tubing started to flow, making 15 to 20 bbl. daily.

Vera. — Considerable drilling will be undertaken this year in the Vera-Unity-Muddy Lake area of western Saskatchewan. Vera Oilfields 3, LSD 11, 12-42-24w3 has started drilling, having skidded rig from the original location, where artesian water was struck. Bata Oils 1, LSD 8, 14-39-33w3, has let contract for completion from 600 ft. Franco Oils and Northern Natural Gas Co. will drill five wells this spring in the Unity area.

Nova Scotia. — Interests connected with Northend Petroleums, Ltd., Calgary, are arranging to drill for oil in Nova Scotia, on acreage in the vicinity of Windsor, Truro and Kennetcook. Drilling is expected to start in May.

OKLAHOMA

Coal County Wildcat Is Disappointment

AMERADA PETROLEUM CORP. 1 Johnson, a wildcat about 12 miles east of the Jesse pool, located in SW SE SW 6-1n-10e, Coal County, is to be abandoned after failing to get oil or gas showings in sandy lime at 8,579 ft. This test had been watched closely. Four new locations were made in the West Moore Wilcox field, which now has three good producers. Three of the locations were offsets, but one was a half mile east and a half mile south, in the NW NW 33-10n-3w. The shortage of heavy drilling rigs will delay rapid development of this area, and uncertainty about the action Congress will take toward relinquishing title the Navy holds to the land in the west half of Section 28 is also holding up action. If Mid-Continent Petroleum Corp. 1 Westmeier, now drilling in the SW SW 26-10n-3w, should prove to be a producer, the situation will change quickly, as it would indicate a field of substantial area.

Gulf Oil Corp. 1 Hare, NE SW 8-8n-20w, offset to the discovery well in the West Sentinel field in Washita County, is preparing to run liner and will be watched closely. Interest is increasing in southwestern Oklahoma and several deep wildcats will probably be drilled in the next few months.

OKLAHOMA WILDCAT COMPLETIONS

Carter County: E. M. Boring 1 Nance, SW NW SE 1-4s-3w, dry, TD 3,002 ft.

Cotton County: Red Bed Royalty 1 U. Tah, SW NW SW 14-1s-10w, 500,000 cu. ft. gas, TD 2,211 ft., pay zone 2,140-60 ft.

Garvin County: Ohio Oil Co. Brandidge, NW SE NE 17-3n-2e, 15,000,000 cu. ft. gas through ¼-in. casing choke, shut-in pressure 1,000 lb., flowing pressure 800 lb., TD 3,155 ft., pay zone 2,942-3,155 ft., Viola 3,050 ft., Bromide dense 3,132 ft.

Sinclair-Prairie 1 Nora Banks, NE NW SW 23-3n-1w, dry, TD 3,668 ft., Bromide sand 4,510 ft.

McClain County: Carter Oil 1 Johnson ranch, SW NE 13-8n-4w, dry, TD 10,536 ft., Mississippi lime 9,260 ft., Hunton 9,500 ft., Sylvan 9,847 ft., Viola 9,986 ft., Wilcox 10,462 ft.

Noble County: Barnsdall Oil 1 Johnson, NW SE NE 35-22n-1e, dry, TD 4,654 ft., Wilcox 4,616 ft., second Wilcox 4,642 ft.

Okfuskee County: Texas 1 Keener, NW NE SE 8-10n-10e, dry, TD 4,107 ft., Hunton 4,009 ft.

Pawnee County: J. E. Trigg et al 1 Ripley, NE NE NW 18-21n-4e, dry, TD 4,201 ft., Wilcox 4,177 ft.

Payne County: Sunray Oil 1 McKenzie, SW NW SE 13-18n-3e, 200 bbl. per day, TD 4,160 ft., PB to 2,375 ft., pay zone 2,305-12 ft.

LA.-ARK.

Three Completions Expected Soon in Dorcheat-Macedonia

MAGNOLIA, Ark.—North Louisiana and Arkansas had a quiet week as far as field work was concerned, while the Arkansas Oil and Gas Commission and the Louisiana Department of Conservation respectively were approving the plans for the pressure maintenance project in the Haynesville extension pool.

However, there are three wells drilling below 8,000 ft. in the Dorcheat-Macedonia field, which are expected to be completed soon; with two others drilling below 6,000 ft. In the Atlanta area there are two wells drilling below 6,600 ft.

There are at present nine active wildcat operations in Arkansas, of which Carter Oil Co. 1 Collins, NW SW 32-16-26, seems to be nearest to testing. This well, located about 1 mile north and 3 miles east of the Foukes pool, was waiting on cement to set around 7-in. casing at 3,562 ft., total depth 3,613 ft.

ARKANSAS WILDCAT COMPLETIONS

Union County: C. E. Murdock 1 Felsenthal, SW SW SW 28-16s-17w, dry, TD 3,527 ft.

Curtis Kinard 1 Union Sawmill, NE NW 4-17s-12w, dry, TD 5,011 ft.

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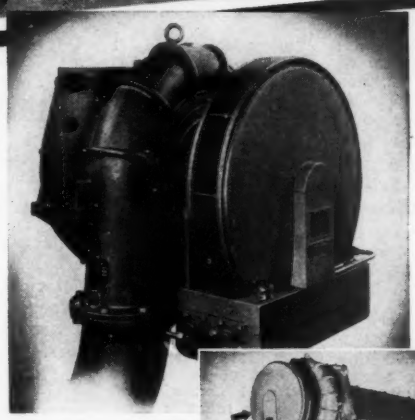

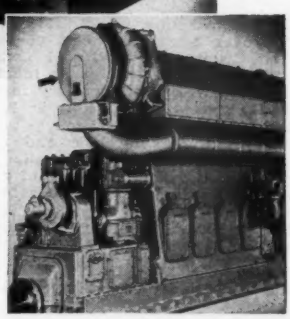

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DISTRICT OFFICES IN PRINCIPAL CITIES

KANSAS

Floods and Bad Weather Slow Wildcat Testing

FLOODS and heavy rains have delayed the testing of several promising wildcats, and slowed down field work. As a result, only six wildcat tests were completed, all dry, one each in Butler, Leavenworth, Marion and Reno counties and two in McPherson County.

Field completions were also off, with Grant and McPherson counties each reporting one gas well; while Rice County had one oil completion, Pratt County two and Russell and Stafford counties each had two oil completions.

Lion Oil Refining 1 Andrew, SE SE SE 24-29-14w, new Simpson sand pool opener near Coats in southwestern Pratt County, was officially reported to have initial production of 713 bbl. per day from Simpson sand at 4,426 ft.

KANSAS WILDCAT COMPLETIONS

Butler County: Adair & Morton 1 Kraft, NW NE SW 9-29-7e, dry, TD 3,194 ft., Arbuckle 3,186 ft.

Leavenworth County: C. N. Miller et al 1 Schwarzer, N½ NW SE 21-9-21e, dry, TD 1,431 ft., Mississippi lime 1,314 ft.

McGuire et al 1 Harrison, SW NW 5-10-21e, dry, TD 1,365 ft., Mississippi lime 1,342 ft.

Marion County: Westgate-Greenland 1 Stegeman, W½ SE SW 1-17-2e, dry, TD 3,100 ft., Hunton 2,845 ft., Sylvan 2,960 ft.

McPherson County: Plains Exploration et al 1 Baldwin, NE NW SE 26-18-2w, dry, TD 3,003 ft., Mississippi lime 2,968 ft.

Allison & Duree 1 Rupp, SW NW 13-21-2w, dry, TD 3,419 ft., Viola 3,417 ft.

Reno County: Vierson & Cochran 1 Miller, SE NW NE 31-25-9w, dry, TD 4,360 ft., Arbuckle 4,310 ft.

McGuire et al 1 Harrison, SW NW 5-10s-21e, dry, TD 1,365 ft., Mississippi lime 1,342 ft.

FOREST CITY BASIN

ST. JOSEPH, Mo.—F. C. Miller and Harry Harper will sink the fourth oil and gas test over a structure east of Oregon, in Holt County, Missouri, at 1 Lennis Moss, NW NW NW 4-59n-37w. So much drilling in one place is extraordinary for Missouri. Skelly started with a hole in 1942. Miller and Harper drilled last fall ¾ mile northwest of the Skelly hole and ran 50 ft. low. Then they went ½ mile east and ran 26 ft. low, but had 2 ft. of pay in the top of the Hunton lime. The Skelly hole also had showings. This time Miller and Harper hope to find the first Hunton limestone well for Missouri.

MISSOURI WILDCAT COMPLETIONS

Holt County: Miller & Harper 1 Egger, SW SE 33-60n-37w, dry, TD 2,122 ft.

Westwego Oil Prices Raised By Standard of Louisiana

SHREVEPORT. — Standard Oil Co. of Louisiana has posted the following prices for Westwego, La., crude, effective 7 a.m., April 25: Below 31°, $1.05 a barrel, with a differential of 2 cents to top price of $1.25 for 40° and above. This is an initial posting. Effective on the same date is the company's posting for the Anse la Butte field in Louisiana, where the price is increased 10 cents a barrel to 90 cents for 20°, with 2 cents differential to top price of $1.30 for 40°.

WILDCAT COMPLETIONS AND DISCOVERIES

	Week ended April 29, 1944					Cumulative total 1944				
	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ohio	0	0	0	0	0	0	0	7	18	25
Indiana	0	0	0	2	2	2	0	0	6	8
Illinois	0	0	0	5	5	7	0	0	84	91
Kentucky	0	0	0	1	1	4	0	0	17	21
Michigan	0	0	0	7	7	4	0	0	71	75
Kansas	0	0	0	7	7	18	0	3	129	150
Nebraska-Missouri-Iowa	0	0	0	1	1	1	0	0	7	8
Oklahoma	1	0	2	6	9	15	0	8	73	96
Texas:										
North Central	3	0	0	10	13	19	0	0	90	109
West	1	0	0	6	7	11	0	1	51	63
Panhandle	0	0	0	0	0	0	0	0	2	2
East	0	0	0	1	1	2	0	0	41	43
Gulf Coast	0	0	1	1	2	15	4	4	61	84
Southwest	0	0	1	5	6	12	3	8	76	99
Total Texas	4	0	2	23	29	59	7	13	321	400
Louisiana:										
North	0	0	0	0	0	2	0	0	18	20
Gulf Coast	1	0	0	3	4	3	4	0	22	29
Total Louisiana	1	0	0	3	4	5	4	0	40	49
Arkansas	0	0	0	2	2	2	0	0	18	20
Mississippi and Southeast	0	0	0	0	0	4	0	0	25	29
Montana	0	0	0	1	1	1	0	1	4	6
Wyoming	0	0	0	0	0	6	0	0	6	12
Colorado, Utah	0	0	0	0	0	1	0	0	19	20
New Mexico	0	0	1	2	3	1	0	1	21	23
California	0	0	0	6	6	3	0	5	49	57
Total United States	6	0	5	66	77	133	11	38	908	1,090
Total previous week	9	0	4	46	59					

Shell's Wood River Plant Aids Program

(Continued from page 34)

of 5,000 bbl. per day. One, built in 1939, was among the first in the industry. Its original capacity was 1,500 bbl. per day which was later increased by the addition of more reactor capacity. The units are similar except that one employs shell-type reactors and the other Stratco reactors.

The charge stock for the alkylation plants consists of isobutane removed in the deisobutanizers from the C_4 fraction of the crude and that produced in the isomerization unit, together with butylenes obtained from thermal and catalytic cracking. The isoparaffin and olefin streams are combined before entering the catalytic reactors where the combined feed contacts the sulfuric acid. Products of this reaction are caustic treated in a neutralizer before fractionation.

The unreacted, excess isobutane is removed in a debutanizer and recycled to the deisobutanizers. The debutanized material is then depentanized, furnishing some of the feed to the pentanes plant, and the depentanized product is rerun in a final column. This column withdraws the finished alkylate as overhead. The bottoms may be redistilled and used in motor gasoline.

Isomerization Unit

Expansion of the alkylation facilities necessitated the installation of equipment to increase the availability of isobutane. Accordingly a butane isomerization unit, designed to produce 1,200 bbl. per day of isobutane, was added. The principal source of butane is the C_4 fraction of the crude stream from which the naturally present insobutane has been removed. This provides the comparatively pure butane required for maximum yields.

Further purification is attained in the feed preparation column in which the heavier fractions are removed to go into motor fuel. Complete removal of water is effected in a drying vessel. The dried butane is preheated and mixed with closely controlled quantities of anhydrous hydrochloric acid, the aluminum chloride catalyst, and the catalyst solvent. This mixture then enters the reaction system consisting of three tubro-type mixers in series on which the required pressure is maintained by a back-pressure regulator. Products of the reaction then pass to a catalyst removal column and an HCl stripper. The catalyst thus regained is returned to the system. The isomerizate is neutralized and the isobutane goes to the alkylation unit. The unreacted butanes are returned to the charge stream.

Wood River's isomerization unit contains several pieces of reclaimed equipment which made possible earlier than expected completion. These include the feed preparation column which was obtained from East Chicago, the drying and neutralizing vessels and reactors which were converted from used equipment at Wood River.

Shell's toluene plant at Wood River produces components of aviation gasoline as well as a principal product that would make a highly desirable

100-octane constituent. Toluene has an octane value of approximately 100 and has a high octane blending value. This unit charges the C_8 to C_{10} fraction produced in the second topping plant column.

The feed is charged to a prefractionator which removes the material in the highest boiling range. This cut has been acid treated and rerun for inclusion in finished aviation gasoline but its use will be curtailed with the catalytic cracking units coming on stream. Remaining charge is fed first to an isomerization feed preparation column which produces a cut for the isomerization section and then to a dehydrogenation feed preparation column which produces a fraction for dehydrogenation.

The first fraction is a dimethylcyclopentane concentrate which is isomerized to produce methylcyclohexane. This is charged to an isomerizate fractionator from which the unreacted portion is withdrawn from the top and used in motor gasoline. The methylcyclohexane concentrate is dehydrogenated to produce a toluene concentrate which is charged to the extractive distillation section for purification.

This section consists of two columns, the first of which removes the raffinate excluding toluene and the second of which strips toluene from the solvent for final treatment. The solvent from the second column is then returned to the first. Final treatment of the toluene includes acid treating, caustic washing, and rerunning.

This process was developed by Shell to increase its production of synthetic toluene. The extractive distillation section is similar to a unit placed in operation earlier at Shell's Houston refinery, the first toluene-from-petroleum plant to go into operation to supply United States needs in this war. The isomerization and dehydrogenation sections were installed later and added substantially to the volume of toluene concentrate to be charged to the purification system.

Cumene Plant

The cumene unit at Wood River employs another important wartime process developed and pioneered by the Shell organization. It was particularly important at the time of its development 2 years ago when a serious shortage of 100-octane gasoline existed. Cumene was a major contributor to the increase in production and improvement in quality of aviation gasoline.

Cumene is produced by the catalytic alkylation of propylene and benzene. The C_3 feed is obtained in the common deethanizers of the thermal and catalytic-cracking gas-recovery systems. The benzene, a product of coal-tar processing, is obtained from an outside source. These stocks are combined before entering the feed tank. The combined stream is heated in exchange with the reacted products en route to the reactors. After reaction takes place, unreacted C_3s are separated in a depropanizer and unreacted benzene is withdrawn in a debenzenizer. This benzene is returned to the feed system. The depropanized and debenzenized material is charged to a rerun column which produces finished cumene as an overhead product.

The Wood River cumene unit, like all others, is a converted installation. This conversion required only the addition of a tower for the debenzenizing step and more heat-exchanger capacity with minor piping changes. The ready adaptability of this process was another favorable characteristic. Since it accounted for almost one-quarter of the increase in 100-octane production in 1943, it contributed more than any other single petroleum processing development in the most critical period of the war.

Catalytic Cracking

Twin fluid-catalytic-cracking units are the largest contributing to 100-octane production at Wood River. These units embody the latest developments in design and are the so-called "bottoms drawoff" type. One will charge mixed gas oil and the other, residual stock. The charging material originates in the final fractionation step in No. 3 and No. 4 topping units and in the vacuum distillation section of No. 2 topping unit. The heavy residue produced in No. 3 and No. 4 is charged to a flashing unit to produce a stock suitable for catalytic cracking. This flashing step takes place in a unit converted from four old Dubbs units.

Such use of available equipment was a factor in reducing the equipment required. Three chambers and two stoves which were a part of the refinery's T.V.P. unit have been converted to catalyst bins, two for storage and three for dropout. The T.V.P. furnaces are being used to provide heat for the stabilization and fractionation of catalytically cracked products and for superheating the steam used in the process. High-pressure vessels used in treating the base stock from the cat crackers were cracking vessels from the East Chicago refinery.

Liquid products of the catalytic cracking include aviation-gasoline base stock, a zero-pour distillate fuel oil and a heavy gas oil that is charged to thermal cracking. The base stock is treated by a hydrogenation process of Shell design which effects desulfurization, improves the lead susceptibility and octane number of the product and makes it more stable through the removal of olefins.

The charge to the treating section is combined with a hydrogen stream obtained from the dehydrogenation section of the toluene plant. It is preheated in exchange with products of reaction and heated further in a furnace before passing to the reaction system. The reacted products are cooled and passed to a high-pressure separator which removes the excess hydrogen. This excess is returned to the system after being treated in a Shell developed potassium phosphate treater. Liquid from the separator is fractionated in a column which removes the pentanes for further processing in the pentanes plant leaving a product high in aromatics and in lead susceptibility as base stock for aviation gasoline.

Summary

The 14 units briefly described in the foregoing are the principal suppliers of 100-octane components at Wood River. Subsidiary units, such as the new Dubbs thermal crackers with a combined capacity of 33,000 bbl. per day, the reforming section, and auxiliary units, such as the original isooctane plant, also contribute. Gases produced in cracking and reforming operations constitute some of the feed for the gas system which, in turn, directly produces 100-octane components or charge stock for alkylation. In the event of an alkylation-plant shutdown, or at a time when an excess of C_4s is available, the 9-year-old isooctane plant is put into use. The C_4s are converted to C_8 olefins by hot-acid polymerization and the olefins saturated in the hydrogenation section using hydrogen produced in the toluene plant.

In addition other units in the refinery also produce products that have been or are in critical demand. Among these is petroleum coke. Manufacture of this product is featured by the use of hydraulic decoking chambers, another development of Shell research. Other important products are high viscosity index lubricating oils produced in a recently enlarged plant equipped with Duo-Sol solvent extraction, propane dewaxing and deasphalting processes. One of the lubricants is turbine oil specified by the U. S. Navy.

This review of the conversion and expansion of Wood River to attain a maximum rate of production of war products is a picture of the change in the status of the industry from a peacetime to a wartime basis. However, there are two particularly notable features about the program at Wood River. Here the company was producing 100-octane components well before Pearl Harbor. Upon completion of this program Wood River will be able to produce a very high percentage of 100-octane aviation gasoline on the basis of crude run, in the neighborhood of 25 per cent by volume, which is higher than any refinery except a few designed and built since Pearl Harbor especially for making aviation gasoline.

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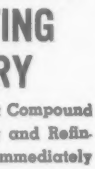

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Drilling Contractors

General Drilling Co. has been awarded contract to drill a wildcat for R. S. Lytle on the Green Wing property, 15-5s-11w, at Westminster, in Orange County, California.

Severns Drilling Co. recently spudded a new wildcat on the Porter property in the Mountain View wildcat district of Kern County for Tide Water Associated Oil Co. and has resumed drilling following the landing of surface pipe at 910 ft.

T. P. Pike Drilling Co. has the contract to drill a well for Tide Water Associated Oil Co. in the recently discovered basal Pliocene zone in the Buena Vista Hills field of Kern County, California. If developments prove this zone to be an extensive accumulation, numerous wells will be drilled there this year and drilling contractors will play an important part in operations.

Jackson Drilling Co. was making progress at the 2,000-ft. level on its 1-B McCorley, in the Hazard Anderson Survey, Wood County, Texas. The well will seek Paluxy production. It is the third operation by the firm for that locality.

R. R. Kirchner has been awarded the drilling contract on the Ashland Oil & Refining Co. 1 Mills, in NE SE SE 35-15-9e, Creek County, Oklahoma. This well will be the 40-acre north offset to the J. Garfield Buell, which opened a rich shallow pool. Kirchner also drilled the Buell well, which was supported by Ashland.

Delta Drilling Co. is drilling contractor on a test E. T. Wix has started in Section 22-P-19, Union County, Kentucky.

Smith Brothers Drilling Co. stopped at 3,072 ft. on its 1 Harris, in NE SW NW 24-7n-5e, Seminole County, Oklahoma, and ran and set 7-in. casing on top of the Earlsboro sand at 3,037 ft. The Checkerboard lime was picked up at 1,750 ft., the Calvin sand at

Crow Drilling Co. crew at Atlantic Refining Co. 1 Dodson Unit, Dorcheat-Macedonia pool, Arkansas: (Standing) R. L. Bowers, derrickman; A. E. Madole, driller; L. Willingham, foreman. (Sitting) S. P. Powell, backupman, and R. L. Strange, pipe racker

2,130 to 2,153 ft. for a show, the Senora lime at 2,790 to 2,085 ft. for a small show of oil, and the Earlsboro, which is to be tested.

George McCamey, drilling contractor of Fort Worth, Tex., has been awarded the contract to drill an 8,500-ft. test, or deeper, for Stanolind Oil & Gas Co., at 1 J. H. Pullen, near center of Lot 133, Land District 10, in Mitchell County, southwestern Georgia.

Warren Bradshaw Drilling Co. has been awarded drilling contract on the Coronado Oil Co. 1 Tyner, in NW NW SW 30-9n-2e, Seminole County, Oklahoma, and will begin work when it has finished at The Texas Co. 1 McLaughlin. Derrick has been completed.

B. & T. Drilling Co., Falls City, Neb., has drilling contract on the F. C. Miller and Harry Harper 1 Lennis Moss, location for which has been staked in NW NW NW 4-59n-37w, Holt County, Missouri.

Denton & Spencer, Calgary, Alta., have the contract for completion from 600 ft. of 1 Bata Oils, LSD 8, 14-39-33w3, in the Muddy Lake area of western Saskatchewan, drilling to commence early this month.

Charles Withers Drilling Co., Regina, Sask., has a drilling contract with Vera Oilfields for drilling of 3 Vera, LSD 11, 12-42-24w3, in the Vera-Unity area of western Saskatchewan.

Elmer H. Wahl, for some time in the land department of Anderson Prichard Oil Corp., has resigned and on May 15 will join R. Olsen Oil and **Olsen-Blount Drilling** companies as assistant manager.

Arrow Drilling Co. has been awarded drilling contract on the Culbertson & Irwin, Inc., 1 O. L. Barnes, C E¼ E¼ of Section 134, Block 10, H&GN Survey, north central Pecos County, Texas. The wildcat will go to 5,000 ft. to the Ellenburger. Location is 7 miles northeast of the Apco-Warner pool and 5 miles north of Oswego. Drilling will start May 10.

Richmond Drilling Co. has contract for a test Byrd-Frost, Inc., of Dallas, will drill in West Reagan County, Texas, about 5 miles northwest of the Big Lake pool. The test will drill to at least 4,000 ft., and will start early this month. Contractor will use cable tools.

Oil Industry Preserves Its Fine Accident Record

NEW YORK.—The oil industry kept its excellent accident-prevention record virtually intact in 1943, notwithstanding thousands of new and untrained employes, all-time record production, and an increase of 8 per cent in hours worked per employe, according to a statement issued by American Petroleum Institute's department of accident prevention.

The severity rate (number of days lost per thousand hours worked) is lower than in 1942. The frequency rate (number of disabling accident per million hours worked) increased 10 per cent, or only slightly more than the percentage increase in number of hours worked per worker.

The 1943 oil-company frequency rate of 12.87 was only 11 per cent above the all-time low frequency figure of 11.59 reported for 1940. The 1943 severity rate of 1.30 was the lowest on record. The 113 fatalities and permanent total disabilities for 1943 are the equivalent of 33.7 per 100,000 employes as compared to 31 per 100,000 in 1942, an increase of 9 per cent.

Two hundred two oil companies employing 335,570 persons are included in the 1943 report, which is 22 more companies and 242 more employes than were included in the 1942 summary.

Ickes Sees Oil Prospects In Washington, Oregon

WASHINGTON.—Active interest in the oil and gas potentialities of Washington and Oregon is being manifested, according to Petroleum Administrator Harold Ickes in a letter to Representative Norman, of Washington, which has been made public. Ickes said drilling could be done at moderate cost and the Reconstruction Finance Corp. was authorized to help finance such projects by those qualified for loans.

Norman had called Ickes' attention to statements that the Olympic Peninsula in Washington showed promise of underlying oil deposits and quoted oil men as saying that the peninsula some day would "rank with southern California as an oil field."

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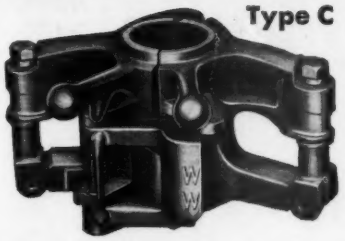

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SEE COMPOSITE CATALOG— PAGES 3101 to 3120

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PERSONALS

Brings Management Experience to New Post

S. B. IRELAN, new president of Cities Service Gas Co., Bartlesville, Okla., brings to his post a broad experience in the engineering, operating, financing and management of gas and electric companies. He has been connected with Cities Service Co. and its subsidiaries 35 years.

Upon graduation from the engineering department of Purdue University in 1909, Irelan went to Denver, Colo., and enrolled in the Cadet Engineering Training School of Denver Gas & Electric Co. Upon completing this course he was made secretary and treasurer of Fremont Gas & Electric Co. in Fremont, Neb.

Irelan has occupied many positions in the Cities Service organization, having been vice president and general manager of Bartlesville Gas, Electric & Street Railway Co., The City Light & Traction Co., Sedalia, Mo.; The Montgomery Light & Water Co., Montgomery, Ala.; and St. Joseph Railway, Light, Heat & Power Co., St. Joseph, Mo. At the time of his election to the presidency of Cities Service Gas Co. he was vice president of Electric Advisers, Inc., in charge of original costs, rates and valuation studies. He has served as president of the Southeastern geographic section of National Electric Light Association and also of the Midwest geographic section.

Fred H. Moore, Magnolia Petroleum Co., Mount Vernon, was elected president of Illinois Geological Society at its recent annual meeting in Mount Vernon. **Lee C. Lamar,** Carter Oil Co., Mattoon, was chosen vice president, and **Everett F. Stratton,** Schlumberger Well Surveying Corp., Mattoon, secretary-treasurer.

Howard L. Miller, geologist for Cities Service Oil Co., has been transferred from the headquarters office in Bartlesville, Okla., to Houston.

Oscar K. Holman, formerly a production foreman for The Texas Co., is now general superintendent for The Salt Dome Oil Corp., Houston.

Theodore R. Donlan, supervisor of Standard Oil Co. of New Jersey's solvents laboratory at Bayway, N. J., has been nominated for secretary of the North Jersey section, American Chemical Society. Two Standard Oil Development Co. men, **W. J. Sparks,** assistant director of the chemical division, and **R. N. Meinert,** a group head in the research division, are candidates for national councilor. The election is conducted by mail.

Fred J. Hill has resigned his position in the land department of Continental Oil Co., Houston, to engage in independent operations in Alabama, Florida, Georgia and Mississippi.

Dr. Charles N. Gould, dean of Oklahoma Geological Survey and its director from 1924 to 1931, is recovering from illness which prevented him from attending the American Association of Petroleum Geologists convention last March. He was made a life member of the association at the convention.

L. ABRAMSON, JR.

Louis Abramson, Jr., New Orleans, was reelected president of Liquefied Petroleum Gas Association at the organization meeting of the new executive board of directors held last week in Chicago. Other officers reelected are: **Harry K. Strickler,** Erie, Pa., and **D. D. Purrington,** Los Angeles, vice presidents; **Florence Jacob,** acting secretary and treasurer.

Edwin L. Fowler, 94, retired oil man of Tulsa, was removed to a hospital in that city last Sunday, critically ill. Born in Pennsylvania, Fowler was an "oil dipper" at 15, and he was in the drilling or some other branch of the oil business most of his active life.

P. S. Clark, superintendent of compound shipping and asphalt operations at the Oleum refinery of Union Oil Co., has been appointed manager

J. S. Leach, vice president of The Texas Co., presented service awards to 97 veteran employes at the annual dinner of the Texaco Old Timers' Club. At the speakers' table, shown in the picture, were Leach; L. E. Barrows, manager production department; T. J. Donoghue, former vice president (retired); Ira McFarland, comptroller; A. M. Donoghue, manager crude-oil purchases and sales division; R. B. McLaughlin, vice president The Texas Pipe Line Co. McFarland has been with The Texas Co. since it was organized 42 years ago

of the company's Los Angeles refinery succeeding the late J. C. Reeder.

C. P. WATSON

C. P. Watson, Seaboard Oil Co., was reelected president at the annual meeting of Oil Producers Agency of California. **W. C. Whaley,** vice president Barnsdall Oil Co., was chosen first vice president; **H. E. Woodworth,** Safe Oil Co., second vice president; **R. H. Garrison,** Hellman Estate, third vice president; **C. C. Spicer,** president of Republic Petroleum Co., fourth vice president; **Rush M. Blodget,** Blackfoot Petroleum Co., executive vice president; **W. A. Russel,** Seaboard Oil Co., secretary-treasurer; **Verne Harrell,** Bankline Oil Co., assistant secretary-treasurer. One new director was added to the board, **Edward Crail,** of Crail Brothers, Inc.

E. W. Mudge, Pittsburgh, was elected board chairman, and **O. G. Leichliter,** Dallas, president, of Mudge Oil Co. at the annual meeting in Dallas last week.

Herman J. Luette, an 8-year employe of The Shamrock Oil & Gas Corp., was recently promoted to automotive shop foreman at the McKee plant, near Sunray, Tex.

Hal L. Dyer, McKinney district, Texas, manager for Lone Star Gas Co., has been made chairman of the Postwar Planning Board for his community.

Edward L. Clark, professor of geology at Drury College, Springfield, Mo., has been made state geologist, succeeding the late Dr. H. A. Beuhler.

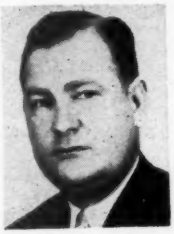
Volney A. Acheson, seismograph operator for Carter Oil Co., Tulsa, left recently for Dominican Republic, where he will do geological work for several weeks.

Dr. Henry J. Welge, formerly professor of chemistry at Texas A. & M. College, is now senior chemist on the production research staff of Carter Oil Co. in Tulsa.

Louis H. Desjardins, aerogeologist, has been designated a research associate in the Princeton University department of geological engineering for the spring quarter.

Joseph L. Quinn has resigned as chief scout in Texas for Pure Oil Co. to become division land man for Warren Petroleum Corp., with his headquarters in Fort Worth. He will be in charge of Warren's East Texas, North Texas, West Central and West Texas districts. He is succeeded as chief scout for Pure by **J. F. Brannan,** who has spent the last 3½ years with the company at Wichita Falls and who has seen 21 years service with Pure.

T. Ellwood Webster, formerly assistant to the vice president, manufacturing department, of Sun Oil Co., Philadelphia, has been named assistant to the president, in charge of all material and project priorities. **John R. Bates** succeeds him in his previous position.



H. Layton Johns, of Freeport Sulphur Co., New Orleans,, was elected president of National Oil Scouts and Landmen's Association at the annual convention in Dallas last week. Johns, born in Alvarado, Tex., graduated from high school in Fort Worth, attended University of Texas, and joined Freeport Sulphur in 1933, serving as scout in South Louisiana and Mississippi since 1937. He was editor-in-chief of the association's yearbook for 1943.

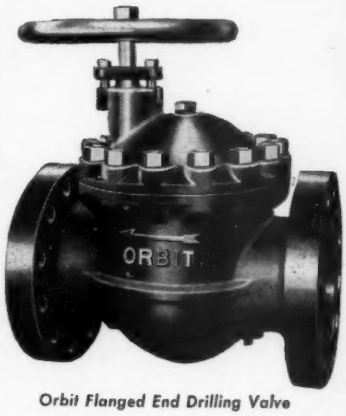
M. R. Walton, sales manager of the oil refinery division, Arthur G. McKee Co. for the past 17 years, will leave New York June 1 to establish his home in the Southwest. In his own words, Walton, widely known among refinery operators in the United States and other countries, is "not retiring, but demobilizing, to allow more time to follow personal inclinations." Walton, whose principal hobby is knowing people, graduated from Carnegie Institute of Technology. He entered the oil business in 1923 as sales manager of Wilson-Snyder Manufacturing Co. He is a member of several clubs and is particularly interested in organizations connected with Latin-American activities.

H. A. Coffin, general manager of the White Star division of Socony-Vacuum Oil Co., was the principal speaker April 27 at ceremonies in Tulsa celebrating the centennial anniversary of the national Y.M.C.A. by burning a $56,000 mortgage against the Tulsa branch. Coffin is president of the National Council of Y.M.C.A.'s in the United States and of the Detroit branch of the organization. Under his leadership the Detroit branch raised $5,000,000 for buildings.

ORBIT

DRILLING VALVES ARE QUICK OPENING

ONLY 2½ to 5 TURNS ARE REQUIRED TO FULLY OPEN OR CLOSE THE ORBIT DRILLING VALVE. THE SEATS ARE PROTECTED AGAINST DAMAGE FROM DRILLING TOOLS AND WIRE LINES.



Orbit Flanged End Drilling Valve

ORBIT DRILLING VALVES ARE AVAILABLE IN BOTH FULL OPENING AND NOMINAL OPENING SIZES. WITH FLANGED OR SCREWED ENDS.

See pages 2194 to 2211 in 1944 Composite Catalog

ORBIT VALVES

OIL WELL IMPROVEMENTS CO.

Since 1912

Tulsa, Oklahoma

MARKET QUOTATIONS

Prices as of May 2, 1944

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon.)

REFINERY GASOLINE

Octane (A.S.T.M.):	80†	72-74
Mid-Continent*	6.00-6.25	5.750-6.000
Gulf Coast	6.00-6.50	‡5.750-6.250
Northeast Coast	9.80	9.200
California		6.255-6.500

*Basis Oklahoma Group 3. †1939 C.F.R. (research method.) ‡Unleaded.

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	4.750	5.700
North Texas	4.375	5.250
North Louisiana	4.375	5.250
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per barrel.

East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana	1.18
Illinois basin	1.37
Pecos County, Texas	.93
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas*	1.08

*No change since 5-21-41.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Texas	West Texas*
18-18.9	$0.80	....	....	....
19-19.9	.84	....	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.09	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.12

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended April 29, 1944

(Fiugres in thousands of barrels)

	Dly. crude runs to stills	Stocks— Gasoline	Residual	Gas oil
Appalachian	166	3,654	336	895
Ind., Ill., Ky.	743	20,150	2,665	4,930
Okla., Kan., Mo.	354	8,429	1,198	1,469
Censored area*	2,220	38,697	15,439	14,928
Rockies	107	2,297	571	362
California	800	15,502	30,852	7,911
Total 4-22-44	4,390	88,729	51,061	30,495
Total 4-15-44	4,447	88,778	51,714†	30,561
Total 4-24-43	3,743	90,751	67,494	30,838

*Reports combined on East Coast, Texas Gulf Coast, Louisiana-Arkansas and Inland Texas at request of PAW.

†On new basis due to reclassification of "other" stocks in California.

CRUDE OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
4-22-14	233,632
4-15-44	234,188
4-24-43	243,035

*Excludes unrefinable stocks in California.

Haynesville Unitization and Repressuring Project Approved by State Commission

EL DORADO.—The Arkansas secondary oil-recovery program took another forward stride this week when the Arkansas Oil and Gas Commission approved unanimously the proposed unitization and repressuring, or pressure-maintenance project, in the Haynesville extension area of Columbia County.

Commission approval was given after 10 technical witnesses, including petroleum engineers, geologists and oil company executives praised the project as a conservation measure designed to increase the ultimate recovery of oil from the entire field in Arkansas and Louisiana.

They pointed to the waste of about 20,000,000 cu. ft. of gas daily, together with the large amount of natural gasoline, and the declining pressure as evidence of the need for immediate action. They also said failure to adopt a repressuring project would speed abandonment of the field and result in leaving much oil in the ground.

The commission's action cleared the way for immediate launching of the program since a similar order had been issued Monday by the Louisiana commission on the portion of the field in that state. Operators told the Arkansas regulatory body that Petroleum Administration for War approval had been given on the use of critical materials, and that placing of orders for such materials by May 1 was necessary to prevent further delay.

Similar to the project in the Shuler field in Arkansas, the first of its kind in the state, the Haynesville program is expected to increase the the ultimate recovery in the field from 17,800,000 to 24,100,000 bbl., and to boost the recovery of natural gasoline and other light hydrocarbons by 1,700,000 bbl.

The program calls for erection of a pressure-maintenance and gasoline-extraction plant near the center of the field, and construction of lines throughout the entire field. The program involves an expenditure of $1,600,000 through a contract agreement signed by more than 70 per cent of the operators, and about 90 per cent of the royalty owners.

Only the Pettit zone is included in the program. There are 165 wells in the field. Under the repressuring program, 20,000,000 cu. ft. of gas will be returned to the producing formation to maintain reservoir pressure which has been showing a steady decline. About 20 injection wells will be used with gas to be injected in various parts of the field through old wells.

Testimony on the Haynesville project highlighted the statewide hearing at which rules were adopted for the Wisinger area of Miller County. Operational rules for the Dorcheat-Macedonia field of Columbia County as submitted by Director A. M. Crowell were approved with a few minor revisions and encouraging reports were given on the water injection program in the Midway field in Lafayette County.

No changes were made in the allowables for any of the controlled fields. The daily production will be approximately 89,260 bbl.

The commission ordered 160-acre spacing for the Wisinger field and approved integration of interests into a drilling unit on the tract on which the discovery well is located, and another tract to the south on which the second well will be drilled by N. H. Wheless and the Arkla Oil Co., which brought in the initial producer. An application for a third drilling unit as part of an eight-unit program was held in abeyance pending completion of the second well which will be under the supervision of the commission.

In the Dorcheat-Macedonia area, the commission fixed the gas-oil ratio at 2,000 cu. ft. of gas per barrel of oil, and classified oil and gas wells. The body ruled that a well not making in excess of 5,000 cu. ft. per barrel will be classed as an oil well with a "penalty" to become effective above 2,000 cu. ft., and a gas well was defined as one with a gas-oil ratio in excess of 5,000 cu. ft. per barrel, or a well classed by the commission as a gasser.

The Barnsdall Oil Co. reported that highly satisfactory results are being obtained in the Midway combined salt water disposal and water injection program. With four input wells now completed, the Barnsdall company is injecting 6,400 bbl. of water into the producing formation daily—6,000 bbl. of fresh water and about 400 bbl. of salt water being produced from wells in the field.

Barnsdall representatives said the project is moving along as indicated in preliminary studies, and in response to questioning by Chairman Bailey, said no change had been made in estimates that the program would increase the ultimate recovery from the Midway field from 32,500,000 bbl. to 65,000,000 bbl.

Operators in the Magnolia field of Columbia County said definite action toward launching of the salt water disposal project in that field is expected within the next 2 or 3 weeks.

Equipment Progress

Wheeled Extinguisher For Electrical and Flammable Liquid Fires

Kidde Model 100 wheeled fire extinguishers, now manufactured with a nonconducting plastic nozzle shield, combine the quick mobility of portable units with the great fire-fighting power of 100 lb. of highly compressed carbon dioxide. Designed to protect larger hazards than hand portable extinguishers could handle, these wheeled units provide fast action, heavy duty extinguishing. The shielded nozzle is equipped with a long handle grip and a shutoff valve which permits conservation of the gas during changes of fire-fighting position. Like all Kidde extinguishers, the Model 100 is Underwriters' Laboratory approved, bearing their B and C rating as suitable for all flammable liquid and electrical fires. These large wheeled-type extinguishers protect special oil and electrical hazards in power plants, as well as oil pumping stations, garages and large storage spaces. Walter Kidde & Co., Inc., Belleville, N. J.

Three-Way Valve by R-S Products Corp.

The simplified design and quick action of the modern butterfly valve have been applied to a three-way valve, Type 604 (patent applied for). It is designed for quick interchange and mixing service and for all pressures from 15 to 900 lb. per sq. in. It is adapted to manual control as well as power operation and elevated temperatures.

The weight of the electric motor operated unit is 8,500 lb. Dual-finned, lubricated stuffing boxes are provided for elevated temperature and high working pressure. The valve was developed by R-S Products Corp., Wayne Junction, Philadelphia 44.

Viscous Panel Filter

Designated as Model DPV, a new viscous panel filter by Dollinger Corp., is offered primarily for application in ventilation and air conditioning systems where filter resistance up to approximately 0.60 in. of water is permissible.

The new filter is a scientifically designed cell, the filtering medium consisting of a series of crimped layers of galvanized screen cloth and woven copper mesh. This medium, when coated with Pingene PD-10 filter oil, forms an unusually efficient filter. The medium is so arranged within the metal cell that it provides extremely large dirt-holding capacity, thus requiring a minimum of servicing.

The cells are unusually heavy, being made up of 16-gage steel finished attractively with a corrosion-resisting paint, and are fitted with handles and cam-type locking latches which hold the cell tightly in place in its box-type supporting frame, thus positively sealing the unit against air leakage. The box-type supporting frames are so designed and drilled that they can be riveted together to form a flat bank, or, by the addition of angles, a series of "V's," so that a maximum of filter capacity can be installed for any given space.

KELLETT'S NEW AUTOGIRO

Here is the new U. S. Army Air Forces' YO-60 autogiro, produced by Kellett Aircraft Corp., Philadelphia, builders of earlier giro types for the Army. Kellett has completed delivery of a service test lot of these aircraft, which are being operated for tactical studies and instructional work. The craft is powered by a Jacobs 300-hp. engine

Parkersburg Moves Houston Office

The Houston sales office of Parkersburg Rig & Reel Co. has been moved from 6300 Navigation Blvd. to 734 Mellie Esperson Building. P. L. Brooks is division manager, and J. E. Dever is district manager. J. A. Lyne is field engineer, and H. L. Brock is chief clerk.

Trade Literature

Leeds & Northrup Co., 4934 Stenton Avenue, Philadelphia, Pa.—A 15-page general catalog which describes an equipment which continuously and automatically indicates pH, and simultaneously records it on a legible chart. Micromax pH recording equipment consists of just two elements: a rugged glass-electrode assembly and a Micromax recorder. A continuous sample of cooler or water flows through the electrode assembly chamber and a voltage set up between the electrodes is constantly measured, indicated and recorded by the Micromax instrument.

Victor Equipment Co., 844 Folsom St., San Francisco, Calif.—A bulletin covering the company's line of "Gas-O-Dome" regulators. These regulators have gas-loaded, instead of spring-loaded, diaphragms. They are made in several models to handle delivery pressures up to 1,000, 2,000, 4,000 and 5,000 lb. per sq. in. The booklet, of eight pages, is printed in three colors, and is fully illustrated.

Elliott Co., Jeanette, Pa.—Bulletin G-8, the subject of which is steam-jet vacuum-cooling equipment. The application possibilities of cooling by vacuum are detailed and illustrated by photographs and flow diagrams. A chart shows the relationship between temperature pressure and volume of water vapor within the normal temperature range for vacuum cooling. Five essential parts of a vacuum-cooling unit are described.

Oakite Products, Inc. 44C Thames St., New York.—A 28-page descaling manual, which describes successfully used techniques and procedures for increasing output of existing equipment and shortening shut-down time by quickly restoring normal heat-transfer efficiency to such varied types of equipment as gasoline and diesel-engine cooling systems,

lube-oil and jacket-water coolers, refrigerant condensers and compressors, surface condensers and other heat-exchange units.

Genspring, Inc., 500 Fifth Ave., New York 18, N. Y.—A 28-page booklet on the company's NR hanger for piping suspension. The text is a rather technical exposition of the problem of proper pipe-line suspension, and it is illustrated with numerous charts, drawings and photographs.

Diamond Chain & Manufacturing Co., Indianapolis, Ind. — Bulletin 12, describing the flexible shaft couplings manufactured by the company. Horsepower ratings and dimensions as well as enclosing casing dimensions and weights are given with prices for both couplings and casings.

Foster Wheeler Corp., 165 Broadway, New York, N. Y.—Bulletin B-44-5, on the S-A type boiler, which consists of an assemblage of drawings and photographs, together with operating data at a number of well-known plants. An extended and simplified chart gives the heat content of steam.

Master Vibrator Co., Dayton 1, Ohio. A 40-page engineering manual containing essential information on portable gas-electric generator plants. The manual includes simplified explanation of power factor, load factor, mixed loads, power calculations and other vital data in language engineers and laymen alike can readily understand. It is profusely illustrated with photographs, drawings, diagrams and tables.

Republic Supply Opens New Office; Also New Store

Republic Supply Co., Houston, announces the opening of a new district office at 624 Lake Street, Shreveport, La., with J. B. Lionberger in charge.

Lionberger is district manager of the territory comprising Shreveport, Rodessa, La.; Lisbon, La.; Patmos, Ark.; El Dorado, Ark.; Kilgore, Tex.; Talco, Tex., and Jackson, Miss., which are Republic Supply Co. store locations.

L. C. Padden will be in charge of the Fort Worth sales office at 1825 Fair Building, Fort Worth, Tex.

The company also announces the opening of a new store at Kenedy, Tex., under the management of W. G. Jennings.

Fairbanks, Morse in Tulsa

Fairbanks, Morse & Co. has opened a new office in Tulsa. The office is under the management of Frank D. Ratcliffe, district manager, oil industry sales, and is located at 1335 Hunt Building.

Among Equipment Men

Gaso Pump Co. Awarded Army-Navy "E"

The Gaso Pump & Burner Manufacturing Co. of Tulsa has been awarded the Army-Navy "E" for outstanding production work in the war effort, chiefly for its manufacture of pumps for the portable pipe lines used by the armed forces in foreign operations to supply all mechanized units and airplanes, oils and water.

H. F. STOVER

H. F. Stover, secretary-treasurer of the firm, states that formal presentation will be made May 19 at the plant. Paul Griffin,

T. J. FLANAGAN

M. J. FLANAGAN

president, Oklahoma Pipe Line Co., will be master of ceremonies.

Other officers of the firm include T. J. Flanagan, president; M. J. Flanagan, vice president and general manager; and T. H. Flanagan, purchasing agent. Mike and Tommy (as they are affectionately known by oil men all over the world) started the Gaso firm from a humble beginning back in 1916, and the first products were made in a 10-ft. by 16-ft. garage. Growth has been continuous until today their modern plant covers about one city block. This award of the Army-Navy "E" will be another high point in Mike and Tommy's long and successful career. However, they insist that the credit for this achievement should be given to their loyal employes, many of whom have long service records with Gaso.

Two Join Cardox

Additions to the staff of the research division of Cardox Corp., Chicago, are announced by Dr. Charles A. Getz, vice president in charge of research.

Dr. Winfred L. Norem has joined the organization in the capacity of chemical engineer. Dr. Norem was formerly associated with the J-M Service Corp. He received his doctor's degree from Johns Hopkins University in 1936.

John Lee Ballard has also been appointed as chemical engineer. Ballard was formerly an engineer with Fearn Laboratories in Chicago. He is a graduate in chemical engineering of University of Alabama.

Davidson Joins Bethlehem Supply Co.

Bethlehem Supply Co. announces the appointment of Harvey E. Davidson as chief engineer in the manufacturing division of its Tulsa plant. He will be in charge of design of products manufactured by the company at Tulsa. Davidson has had several years experience in this kind of work, having been formerly associated with Cardwell Manufacturing Co. of Wichita, Kans., and more recently with Unit Rig & Equipment Co. of Tulsa.

Kaley Made Vice President By Ethyl Corp.

HARRY W. KALEY

Harry W. Kaley, formerly general sales manager, has been elected a vice president of Ethyl Corp. He will act principally as coordinator for the company. Julian J. Frey of Detroit, formerly manager of the technical service department, will succeed him as general sales manager.

Kaley joined the company in 1927 and for the past 7 years has been general sales manager. Frey, also employed in 1927, has been stationed mostly in Detroit and in recent years has been in charge of technical service. Both men will make their headquarters in New York.

Gooch Heads Sales for Kemp Mfg. Co.

D. B. Gooch has been appointed sales manager for C. M. Kemp Manufacturing Co., 405 East Oliver Street, Baltimore,

Gooch was sales engineer with the Blaw-Knox Division of Blaw-Knox Co., New York, during the past 8

years. Prior to that, he was sales engineer with J. P. Devine Manufacturing Co., Inc., Mount Vernon, Ill., for 7 years.

Previous to these connections, he was chemist for Gulf States Steel Co., Gadsden, Ala., and assistant chemical engineer for Gulf Refining Co., Port Arthur, Tex.

Gooch is a B.S. in chemical engineering from Alabama Polytechnic Institute, class of 1927.

Holbert Joins Lufkin Foundry & Machine Co.

Parke Holbert, formerly with Tide Water Oil Co.'s production department for 10 years in Oklahoma and Kansas and, after leaving Tide Water, developing and operating his own properties, has joined the sales force of Lufkin Foundry & Machine Co. as engineer in charge of West Texas with offices in Odessa.

Climax Appoints George as Special Field Representative

Edward F. Deacon, president of Climax Engineering Co., Clinton, Iowa, and McAlear Manufacturing Co. of Chicago, announces the appointment of Allen S. George as special representative for Climax and McAlear products and engineering specialties in the Mid-Continent and Southwest areas. For the present, George will operate from his headquarters at 3416 Cockrell Street, Fort Worth.

A. S. GEORGE

For nearly 30 years, George has specialized in the application of oilfield and industrial equipment and is widely known among oil men in the Southwest. Prior to his association with Climax and McAlear, he spent 22 years with National Supply, and 7 with the Mid-Continent Supply Co.

Oil Well Announces Personnel Changes

Fred F. Murray, president of Oil Well Supply Co., U. S. Steel subsidiary, has announced appointments and reassignments of sales department personnel throughout his organization.

Lloyd E. Tracy has been appointed general manager of sales, with headquarters at Dallas. He will be assisted by F. D. Smith and A. C. Michaelis. George A. Hays, vice president with headquarters at Dallas, will devote his full time to major sales problems in all domestic areas.

John M. Post will continue as manager of tubular division of the general sales department, with headquarters in Pittsburgh. He will be supported by F. W. Little, assistant manager of tubular division, Pittsburgh.

V. J. Waters, as a member of the general sales department, will continue as manager of used equipment department and manager of merchandise claims department, with headquarters at Dallas. M. D. Routzon has been appointed assistant manager of these departments.

Kenton Chickering will continue to head of advertising and catalog section, Dallas.

M. E. Nicklin will continue as manager of the export division and will be supported by M. E. Keenan, manager of export sales. The export division office is located in New York City.

R. R. McAfee, Columbus, succeeds F. D. Smith as manager of the eastern division, and will be supported by C. H. Maynard, assistant manager, eastern division, and L. M. Woltz, tubular sales representative, eastern division, both located at Columbus.

K. B. Winstead succeeds Tracy as manager of Oilwell's Midwest division and will make his headquarters at Dallas. He will be supported by J. S. Fuller, division engineer, Dallas; R. H. Christy, assistant to the division manager, Dallas; William Heldmar, assistant division manager at Tulsa; Carl C. Egner, assistant division manager at Houston; and later by Paul H. Shepherd, assistant division manager at Fort Worth. Shepherd is now on leave of absence in Washington, D. C., where he is chief of Facilities Review Section, Transportation Division, Petroleum Administration for War.

Warner F. Parker, Los Angeles, succeeds L. L. Mitchell as manager of California division. Mitchell is transferred to Oil City, Pa., as assistant treasurer. Parker will be supported by Clarence J. Hill, assistant to division manager; R. F. Cann, manager of tubular sales; R. T. Watkins, manager of machinery sales; and Albert Lasken, Jr., manager of stores and general sales for the California division.

District manager appointments include: Harold Wright, succeeding L. M. Woltz as manager of the Ohio district, with headquarters at Columbus; C. L. Benezette, Mount Pleasant, Mich., succeeding C. H. Maynard as manager of the Michigan district; C. A. Bell, Houston district manager for the Gulf Coast district, succeeds R. H. Christy.

Johnson Joins Willamette Hyster Co.

Dar Johnson, formerly with the Peoria Journal-Transcript as public relations and industrial promotion manager, is the sales promotion and advertising manager of the Willamette Hyster Co., Portland-Peoria, manufacturers of heavy-duty high-speed hoist equipment for use with "Caterpillar" tractors and Hyster lift and straddle trucks.

Allis-Chalmers Elects Three Vice Presidents

Election of three new vice presidents by the board of directors of the Allis-Chalmers Manufacturing Co. was announced recently by Walter Geist, president.

W. C. JOHNSON

The new vice presidents are William C. Johnson, James M. White and William A. Roberts.

Johnson, who has been general sales manager, came to Allis-Chalmers in January 1924. After serving in various district offices, he became sales manager of the crushing and cement division. Next, he was placed in charge of general sales in May 1942, succeeding Geist, who became president.

J. M. WHITE

W. A. ROBERTS

White came to Allis-Chalmers in 1929. In 1934, he was made manager of the company's La Porte, Ind., works. He returned to Milwaukee in 1941 to become assistant general works manager, and was elevated to works manager in April 1942.

Roberts came to Allis-Chalmers as a salesman after varied experience as a road contractor and salesman. In June 1930 he became agricultural sales manager of the company's tractor division, and in 1941 he succeeded the late Harry C. Merritt as manager of the tractor division.

Exploration Spreading In Mississippi

(Continued from page 30)

the discovery date, the Tinsley oil field had 242 producing wells and a cumulated production of 11,536,392 bbl. of oil. By this date, too, the Pickens oil field had been discovered, had three producing wells and a cumulated production of 441,540 bbl..

Although the Tinsley field continued to be developed, the British American Oil Producing Co. was having trouble with its skidded A-1 F. B. Houston (23-11n-7w) in Sharkey County, which it finally completed on September 16, 1941. Difficulty was also experienced in the attempt to extend the Pickens four-well field, as four dry wells seemed completely to limit the field. These difficulties and discouragements were reflected in the resident membership of the Mississippi Geological Society, which was established by approximately four geologists, grew to more than 100 geologists and geophysicists, and then dwindled to perhaps half that number—the others having left the state.

Pickens Extension

About this time a study was made of the production of the four-well Pickens field, which seemed so completely limited by faults. Estimates of the reservoir capacity, based on the area of the field, the thickness of producing sand, and the porosity of the sand, showed that the capacity had already been exceeded by the cumulated production of the field—hence that there must be drainage from some direction, which it was decided was from the southeast. Completion on December 4, 1941, of his 1 John Whitworth (4-11n-3e), 2 miles southeast of Pickens production, demonstrated the correctness of these conclusions and gave southeastward extension life to the field.

By August 30, 1942, the third anniversary of the discovery well, the Tinsley field had 339 producing wells (one short of the maximum of 340) and a cumulated production of 39,871,494 bbl. of oil. The Pickens field had two producing wells (a decline of two) and a cumulated production of 586,027 bbl. The southeastern extension of the Pickens field had six producing wells and a cumulated production of 167,235 bbl. The Cary (Sharkey County) field had two producing wells and a cumulated production of 4,566 bbl.

By August 30, 1943, fourth anniversary of the discovery well, the Tinsley field had 334 producing wells and a cumulated production of 60,020,445 bbl. of oil. The Pickens field (Yazoo-Madison counties) had 27 producing wells and a cumulated production of 1,726,139 bbl. The Cary field (Sharkey County) had two producing wells and a cumulated production of 24,901 bbl. The new Brookhaven field (Lincoln County) had 1 producing well and a cumulated production of 7,318 bbl.

In this elapsed year, then, the Pickens field had grown to 27 producing wells and the Brookhaven field had been discovered. The Brookhaven production was from a saturated Massive sand, and although California Co. was having completion trouble in the Massive sand in the Cranfield area and Gulf Refining Co. in the Massive sand in Wayne County, nevertheless a saturated Massive sand had been penetrated in the middle of the state, in the western part, and in the eastern part. The search was on again at a greatly accelerated tempo.

During the 5 months ending January 1944, four new fields had been discovered and were in production: Cranfield field (Adams County) two wells and a cumulated production of 20,258 bbl. of oil; Eucutta field (Wayne County), one well and 1,663 bbl.; Flora field (Madison County), two wells and 5,174 bbl.; Heidelberg field (Jasper County), one well and 1,000 bbl. (Map of Mississippi oil and gas fields and salt domes).

In the more recent months of February, March, and April, an additional well has been completed in the Cranfield area, one in the Eucutta field, and one in the Heidelberg field. Five are being drilled in the Heidelberg field and three new locations have been staked. Dixie Geological Service announced on April 20 that Gulf alone had made appropriation to drill 24 wells in the Eucutta field and 54 wells in the Heidelberg.

Selma Productive History

In the Tinsley field 303 wells have produced from the Selma formation, 31 from the Eutaw formation, 2 from both formations, and 1 from the Tuscaloosa; in the Pickens field, at least 28 from the Eutaw; and in the Cary field, 2 from the Cretaceous (Jackson) "gas rock"; in the Flora field, at least 1 from the "gas rock." In the four other fields, the Brookhaven, Cranfield, Eucutta, and Heidelberg, the wells are producing from the Massive sand.

No definite information seems to have been released regarding the thickness of the Massive sand of the basal Tuscaloosa in the Brookhaven (Lincoln County) field. Similarly no detailed information has been released regarding this sand in the Cranfield field (Adams County), but in California Co. 1 and 2 National Gasoline Co. wells the over-all sand section is approximately 125 ft. from the top of the first sand to the base of the bottom sand, of which 30 ft. or more is known to be saturated, even the whole sand section being reported to contain oil. Just as California Co. has experienced much trouble in bringing in 1 and 2 National Gasoline wells in the Cranfield field, so also has Gulf experienced even greater trouble in completing 1 Aden Davis well in the Eucutta field (Wayne County), where definite information is meager.

More information is available concerning Gulf 1 Lewis-Morrison in the nearby Heidelberg field, where, in this well and in the 1 Helen Morrison, some 15 sands total a net saturation of 140 to 180 ft. in an overall sand shale section of 530 ft.—500 ft. in the Eutaw and 30 ft. in the Tuscaloosa. Regardless of whatever success the operators may have in completing these most difficult initial deep wells, the fact remains that a Massive sand more or less saturated with oil and gas seems to extend across the state in the Adams, Lincoln, Wayne-Jasper belt.

Eutaw Extended to Alabama

Development of the Eutaw sand has been pushed some 9 or 10 miles into Alabama. In fact, in this Gilbertown field, at least one of the wells seems to be producing also from broken chalk near the base of the Selma. Similarly, the Mississippi development has given impetus to exploration in Florida and other states.

In many of these productive structural domes, faulting has been revealed by the drill—features that are concealed at the surface by the thick mantle rock. Much more drilling will be necessary before details of the structure of these domes are known in full.

In addition to the two gas fields (Amory, in Monroe County, and Jackson, in Hinds and Rankin counties) eight oil fields (listing the Vaughn and Pickens as one field and omitting the Pure Oil Co. 1 Mrs. J. M. McDowell on the Mississippi River below Natchez), 16 salt domes have been found.

The oil fields are: Tinsley, Yazoo County; Pickens, Yazoo-Madison counties; Cary, Sharkey County; Brookhaven, Lincoln County; Cranfield, Adams County; Eucutta, Wayne County; Flora, Madison County; Heidelberg, Jasper County.

The salt domes discovered are: Byrd, Greene County; Halifax, Hinds County; Carson, Jeff Davis County; Prentiss, Jeff Davis County; Leeda, Jefferson County; Moselle, Jones County; Tatum, Lamar County; Arm, Lawrence County; Monticello, Lawrence County; Ruth, Lincoln County; Lampton, Marion County; Dlo, Simpson County; Stringer, Smith County; Glass, Warren County; King, Warren County; Newman, Warren County.

From past experience in Texas and Louisiana, it would seem safe to conclude that some of these domes will prove productive. All in all then Mississippi seems in an excellent position to experience a real oil, gas, and salt development.

Classified Advertising

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THE BURKHART LINE of Legal Blanks Since 1908. Oil-Gas and Business Forms for Mid-Cont. and Illinois Basin. Leases Rev. with Gov.'s Regulations. Catalog and Samples. Burkhart Ptg. & Sta. Co., 115 So. Cincinnati, Tulsa, Okla.

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SITUATIONS WANTED

GEOLOGIST: Woman, Ph. D. in Stratigraphy from large University. Seven years experience in micropaleontology, sample determination, surface and subsurface mapping. Interested in position requiring variation in type of work rather than specialization in any field. Box C-286, The Oil and Gas Journal, Tulsa, Okla.

EXECUTIVE, age 42, desires connection with progressive organization. 10 years successful management of pipe line system involving construction and operation. Thoroughly familiar with purchasing, office and personnel management, traffic and sales. Invite thorough investigation personal record, excellent health, unopposed to travel. Box C-281, The Oil and Gas Journal, Tulsa, Okla.

GREASE maker and chemist, desires position. Will consider South America. College graduate with about 20 years experience in supervision, grease making, oil blending and compounding. Have laboratory experience in analytical and control work for above. Married, draft 3A (H). W.M.C. certificate, Available. Box C-291, The Oil and Gas Journal, Tulsa, Okla.

REFINERY Superintendent, 20 years experience supervising manufacture of light oils, lubricants and asphalts, desires situation with well established company. Available at once. Box C-296, The Oil and Gas Journal, Tulsa, Okla.

STOREKEEPER, 15 years' refinery experience, desires 48-hour work week on present basic rate. Must have postwar future. Can comply with WMPC. Box C-305, The Oil and Gas Journal, Tulsa, Okla.

DRILLING and Production Superintendent or tool pusher, 15 years' experience, desires connection with growing company in shallow area. Can furnish shallow drilling equipment for interest. Will take interest and living wage. References exchanged. P.O. Box 55, Hugoton, Kansas.

CHEMICAL Engineer with Ph.D. Degree, age 40, Draft 3A-H, married, 15 years' Petroleum Refining experience, supervising plant operation, charge of research and development, construction of 100 Octane Gasoline Refinery. Especially interested in Petroleum Research and development or refining. Would consider responsible position in related industries. Prefer California or East Coast. Have availability certificate. Box C-304, The Oil and Gas Journal, Tulsa, Okla.

REFINERY man, 18 years' experience, tester, treater, yield clerk, sup't. Now employed, desire change. Age 42, family, go any place. Box C-302, The Oil and Gas Journal, Tulsa, Okla.

GEOLOGIST, Ph. D., 42 yrs., nat. citizen in excellent health with distinguished record in Government service and private enterprises here and abroad, experienced in oil structures and paleontology, desires position in oil industry, domestic or foreign. Box C-306, The Oil and Gas Journal, Tulsa, Okla.

HELP WANTED

MECHANICAL DRAFTSMAN WANTED: To redesign, improve, and supervise a line of drilling rigs and production equipment. State experience, age, salary, etc. Reply Box C-273, The Oil and Gas Journal, Tulsa, Okla.

INDEPENDENT oil producer out of city desires accountant capable taking entire charge of office, including income tax; state age, experience, draft status, salary expected in first letter. Box C-272, The Oil and Gas Journal, Tulsa, Okla.

MAJOR oil company has openings available for graduate petroleum engineers having at least 3 years acceptable experience general oil field development. Salary open All hiring will be done in accordance with War Manpower Commission Stabilization plans. Reply to Box C-221, The Oil and Gas Journal, Tulsa, Okla.

CHEMICAL ENGINEERS with experience in any of the following petroleum refining operations (1) light ends recovery equipment, absorbers, stabilizers, etc. (2) catalytic cracking equipment or (3) crude distillation equipment and similar processing units. State in detail educational background, positions held with detailed explanation of work handled, age, and number dependents, also draft status. Foster Wheeler Corporation, Petroleum Refinery Division, 165 Broadway, New York 6, N. Y.

WANTED: A Petroleum Engineer with field experience for engineering development work, with a large manufacturer of oil field equipment and materials. Permanent position with good future for right man. In replying state age, education, business background, salary desired, etc. Box C-250, The Oil and Gas Journal, Tulsa, Okla

WANTED: Shift foreman, 48 hours per week. $300.00 per month, experienced in the operation of Dubbs unit, skimming and vacuum asphalt. Will have charge on his shift of entire plant, directly under Assistant Superintendent. Talco Asphalt & Refining Division, Southport Petroleum Co. of Delaware, Mount Pleasant, Texas.

WANTED

MAN with engineering background having thorough knowledge of modern high and low pressure gas distribution practice, cleaning, dehydration, sizing of equipment, plant layout. Permanent position with large manufacturer. Write giving full transcript of experience. Box C-301, The Oil and Gas Journal, Tulsa, Okla.

HEAT Transfer Design Engineer, to be assistant to manager of plant making heat exchangers for chemical process work. Must be capable of rating heat exchangers. Permanent job with good postwar outlook. Address application to R. M. Armstrong, Downingtown Iron Works, Downingtown, Pa. Certificate of availability needed.

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WANTED: An experienced oil refinery engineer. Must have a thorough knowledge of design and construction. Full qualifications, Age, Education, Salary, last five years experience. Box C-292, The Oil and Gas Journal, Tulsa, Okla.

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LEGAL

UNITED STATES DEPARTMENT OF AGRICULTURE, Forest Service, Jackson, Mississippi, May 1, 1944. Sealed bids in triplicate will be received until 2:00 P.M., Central War Time, June 2, 1944, and then publicly opened, offering bonus for operating rights in connection with gas and oil leases on two parcels of national forest land located in Adams County, Mississippi. One parcel contains approximately 714 acres in Township 7 North, Range 1 West, Section 73, and Township 6 North, Range 1 West, Sections 1 and 2. The other parcel contains approximately 127 acres in Township 6 North, Range 1 West, Section 24. Separate bids will be received on the two parcels. Award of lease will be made only to bidder who can show sufficient experience and financial resources and prove citizenship. Interested parties may obtain bid documents, lease forms and operating regulations from the Forest Supervisor, Masonic Building, U. S. Forest Service, Jackson 114, Mississippi.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that the lands herein described within the Hugoton gas field (undefined), C.M., Oklahoma, are offered to qualified bidders of the highest cash amounts offered per acre as a bonus for the privilege of leasing the land under section 17 of the leasing act, as amended by the act of August 21, 1935 (49 Stat. 674, 30 U. S. C. 226), in the following parcels: Parcel No. 1, SE¼ NE¼ sec. 20, T. 4 N., R. 14 E., 40 acres. Parcel No. 2 NE¼ SW¼ sec. 27, T. 4 N., R. 14 E., 40 acres. Parcel No. 3, SE¼ SE¼ sec. 29, T. 4 N., R. 14 E., 40 acres. Parcel No. 4, lot 2 sec. 2, T. 4 N., R. 15 E., 36.03 acres. Parcel No. 5, NE¼ SE¼ sec. 12, T. 4 N., R. 15 E., 40 acres. Parcel No. 6, SW¼ NW¼ sec. 24, T. 3 N., R. 16 E., 40 acres. Parcel No. 7, SW¼ SW¼ sec. 27, T. 4 N., R. 16 E., 40 acres. Parcel No. 8, lot 2 sec. 10, T. 6 N., R. 16 E., 30.35 acres. Parcel No. 9, NW¼ sec. 26, T. 6 N., R. 16 E., 160 acres. Sealed bids will be received in the office of the Secretary of the Interior, Interior Building, Washington, D. C., up to 12 noon May 16, 1944. Each bidder must submit a certified check or cash for one-fifth of the amount bid, payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease, required by section 7 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of $1 per acre must be paid and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the unsuccessful bidders will be returned. The envelopes should be plainly marked "Bid for Parcel No. . . . ., Hugoton gas gas field. Not to be opened before noon May 16, 1944." No bids received after the time fixed herein for submitting bids will be considered. Bidders are warned against violation of section 59 of the U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

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Journalisms:

IN the initial development of any new field one of the greatest hazards lies in the uncertainty of what to expect in the way of drilling conditions. Such is true of the recently opened Heidelberg field, Jasper County, Mississippi. Until one of the wells now drilling blew out, no indications of the existence of gas had been given in the field and no special precautions to combat pressures had been deemed necessary. Now, however, especially since there is a chance that some of the upper sands may have become charged from the blowout, additional measures are having to be taken to safeguard future wells. Drilling practices being formulated to meet these conditions will be described by a staff writer in an article in next week's issue of the Journal. The article will be one of a series on various phases of Mississippi operations.

ONE of the outstanding papers delivered before the recent meeting of the Natural Gasoline Association of America at Houston, was a discussion by E. O. Bennett on centrifugal compression of hydrocarbon gases. The author reviews briefly the history and development of prime movers, using this principle, and then launches into an extended discussion of centrifugal compressors. While centrifugal compressors are now built for discharge pressures up to 400 lb. per sq. in., there is no reason they cannot be designed for operating up to 3,000 lb. per sq. in. or more. This paper will be included in next week's Engineering and Operating section.

THE methods for operating a 300-mile 10-in. crude-oil pipe line in Illinois, Indiana, and Ohio will be described in next week's issue by John G. Norton, chief mechanical engineer, Magnolia Pipe Line Co. Because of the nature of the design of pumping stations and the schedules followed by operating engineers and dispatchers, it has been possible to move shipments consistently through the line at more than the rated capacity without having spare pumping units at the stations.

The article discusses in considerable detail the features of station design, inspection and maintenance programs and the manner in which scrapers are put through the line under the various seasonal temperature conditions which affect the hydraulic efficiency of the system.

CALENDAR

May

A.I.M.E., Gulf Coast Section, annual meeting, Houston, Tex., May 8-10.

NATIONAL OIL AND GAS POWER CONFERENCE, sponsored by A.S.M.E., Tulsa May 8-10.

A.G.A., NATURAL GAS DEPARTMENT spring conference, French Lick Springs Hotel, French Lick, Ind., May 11-13.

A.P.I., Mid-Continent District, Production Division, Mayo Hotel, Tulsa, May 25-26

June

CANADIAN GAS ASSOCIATION, annual meeting, Royal Connaught Hotel, Hamilton Ont., Canada, June 8.

A.P.I., SOUTHWESTERN DISTRICT, PRODUCTION DIVISION, Rice Hotel, June 13-14

KENTUCKY OIL AND GAS ASSOCIATION, midyear meeting, Lexington, Ky., June 24.

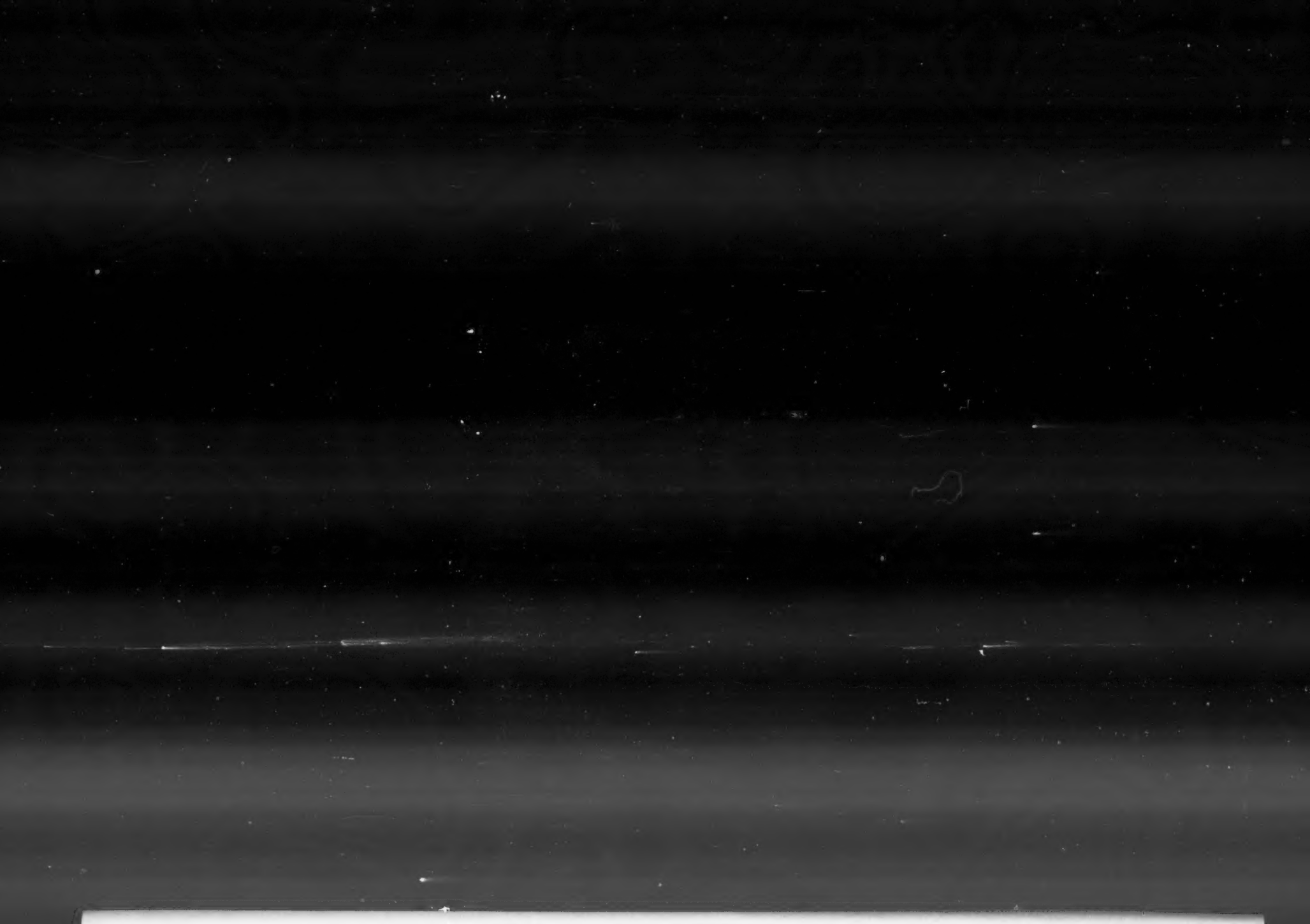
A.S.T.M., forty-seventh annual meeting Waldorf-Astoria Hotel, New York, June 26-30.

September

N.P.A., annual meeting, Hotel Claridge Atlantic City, N. J., September 20, 21, 22

October

C.N.G.A., annual meeting, Biltmore Hotel, Los Angeles, October 13.

November

A.P.I., annual meeting, Stevens Hotel Chicago, November 13-16.